April 1984

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sinclair user

Issue No 25

Only 85p

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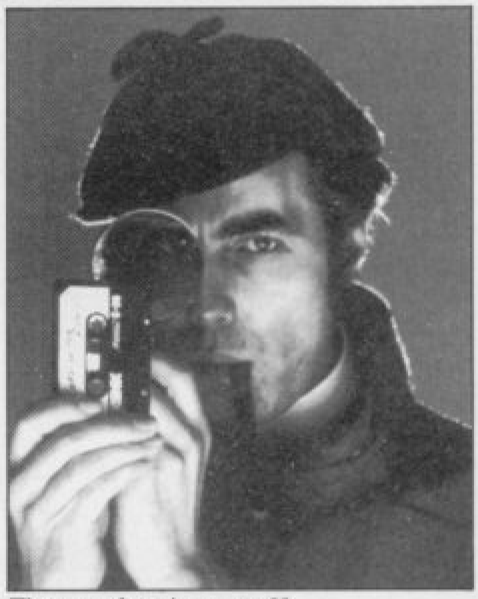
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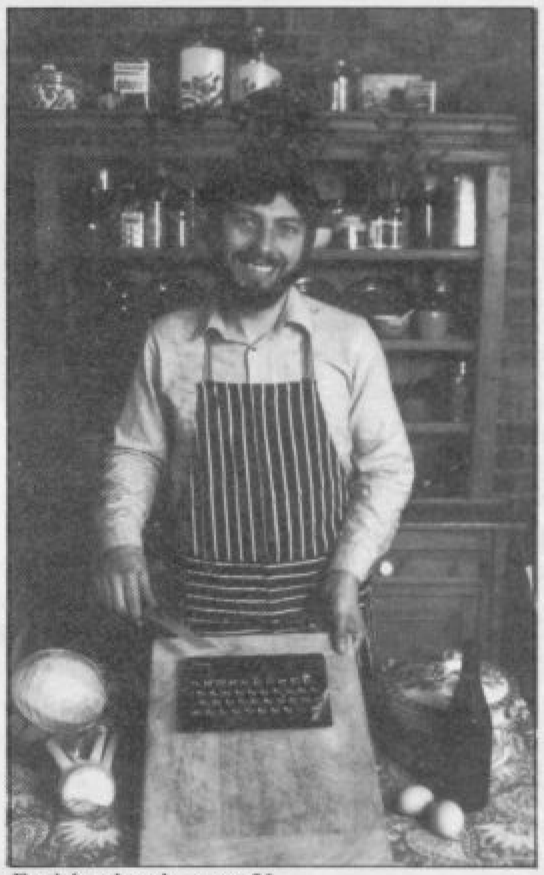
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NEXT MONTH



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No time for complacency

THE JUNIOR INDUSTRY MINISTER, Mr John Butcher, has predicted that by 1986 half the households in the U.K. will have a computer. Mr Butcher was speaking at the Computer Trade Association awards ceremony earlier this year, and he went on to describe the schoolchildren of today as the first generation of the computer literate. He added: "Because of this world lead — a direct result of the co-operation between Government and the education sector — the U.K. will have the skilled manpower to exploit the burgeoning information market, especially in software."

The extravagant claim that it is the present Government which has fostered computer literacy through the Microelectronics Education Programme will make many teachers fall about laughing. If children are becoming computer literate — and that is questionable — then they are doing so at home, not in schools which cannot even boast of having a micro for each class, let alone each pupil.

The Microelectronics Education Programme was initiated, belatedly, in 1981, two years after it was ready to move. The Labour Government had planned the scheme to begin in 1979, but lost the General Election and the new Conservative Government immediately called a halt to the project as part of the general cutbacks in expenditure. An inauspicious start, and one which Butcher has conveniently forgotten.

Three years later, the Department of Education and Science reports on the progress of MEP: "the current position in the United Kingdom is that each secondary school, some 5,500 in all, now has at least one microcomputer", and on average there are five computers in each of those schools. Only one-third of primary schools, however, has any computers at all, and the majority of those have only one. In total, then, less than 50,000 computers have been purchased by schools. Scarcely a figure to be proud of, particularly when compared to the 1.19 million home computers sold to first-time users in 1983.

> 'If children are becoming computer literate they are doing so at home'

Consequently, computers in school tend to be used, if at all, as demonstration models in the few classes receiving tuition in computer science. In many instances, the only hands-on experience gained by pupils is in after-school computer clubs organised by enthusiastic staff, and those tend to appeal to those who already have a computer at home.

One cannot blame the schools themselves — at least, not entirely. Computers cost money, and even with the help of the MEP schools must shoulder 50 percent of the expense of hardware and software. With the present cutbacks, schools are finding it difficult enough to buy textbooks, and for effective teaching computers must be bought in large quantities. There is a little a teacher can do with one Spectrum plus hardware and a class of 35 pupils.

Nevertheless, some progress has been made. Within the past 30 months, according to DES figures, 80,000 teachers have taken courses in computer awareness. That, however, is not enough, and schools have lagged so far behind in the teaching of computer science that universities have taken to giving remedial tuition on the subject to post-A level students. Richard Ennals, of the Department of Computing at Imperial College, London, spoke of the problem at the North of England Educational Conference in Sheffield: "Teachers must be properly trained and the number of computer science teachers increased. It is not enough to provide schools with microcomputers which would only produce a generation of poor Basic programmers."

Those poor Basic programmers are likely to be self-taught, too, as a growing number of schoolchildren become familiar with micros at home. A recent survey by Gowling Market Services showed that 11 percent of homes in the U.K. now have a computer. Well over one million people bought a computer for the first time last year, and nearly two million are expected to do so in 1984. The hands-on experience which children fail to get at school is gained at home, though one unfortunate aspect is that it is only the children of the better-off who learn in that way. Due largely to the failure of MEP to provide all pupils with a computer education, the subject has become, unintentionally, one from which the less well-off children are excluded.

In any case, how literate is that generation of computer kids? What skills will they have to offer in the future? Most Sinclair users would agree that computer literacy has nothing to do with reaching Cavern 20 of Manic Miner or scoring 79 percent on The Hobbit. Fortunately, few people use their computers only for playing games. The majority also devote considerable time to programming and learning about the new technology. It cannot be said, however, that those skills will ensure a career in computing. After all, the ability to drive a car and tinker with an engine does not qualify one as a motor mechanic, and even if it did, society requires only a limited number of garage hands.

It must be remembered that a computer is, in the final analysis, only a tool, albeit a very sophisticated one. Familiarity with that tool is essential, as we move ever nearer to a fully computerised society, but far too great an emphasis is placed on programming skills which, one day, with professional software available for every application, will be simply a hobby for most users. In the meantime, schools should, ideally, be using computers in every discipline in order that pupils become accustomed to their use and potential. That will better equip people to use computers in everyday life, and they will become expert in using the new technology rather than in programming.

> 'Far too great an emphasis is placed on programming skills'

The Government, too, should look carefully at the implications of computers, and instead of being complacent about a so-called computer literate generation which it has done little to foster, it should begin thinking now about educating the public to make good use of increased leisure time.



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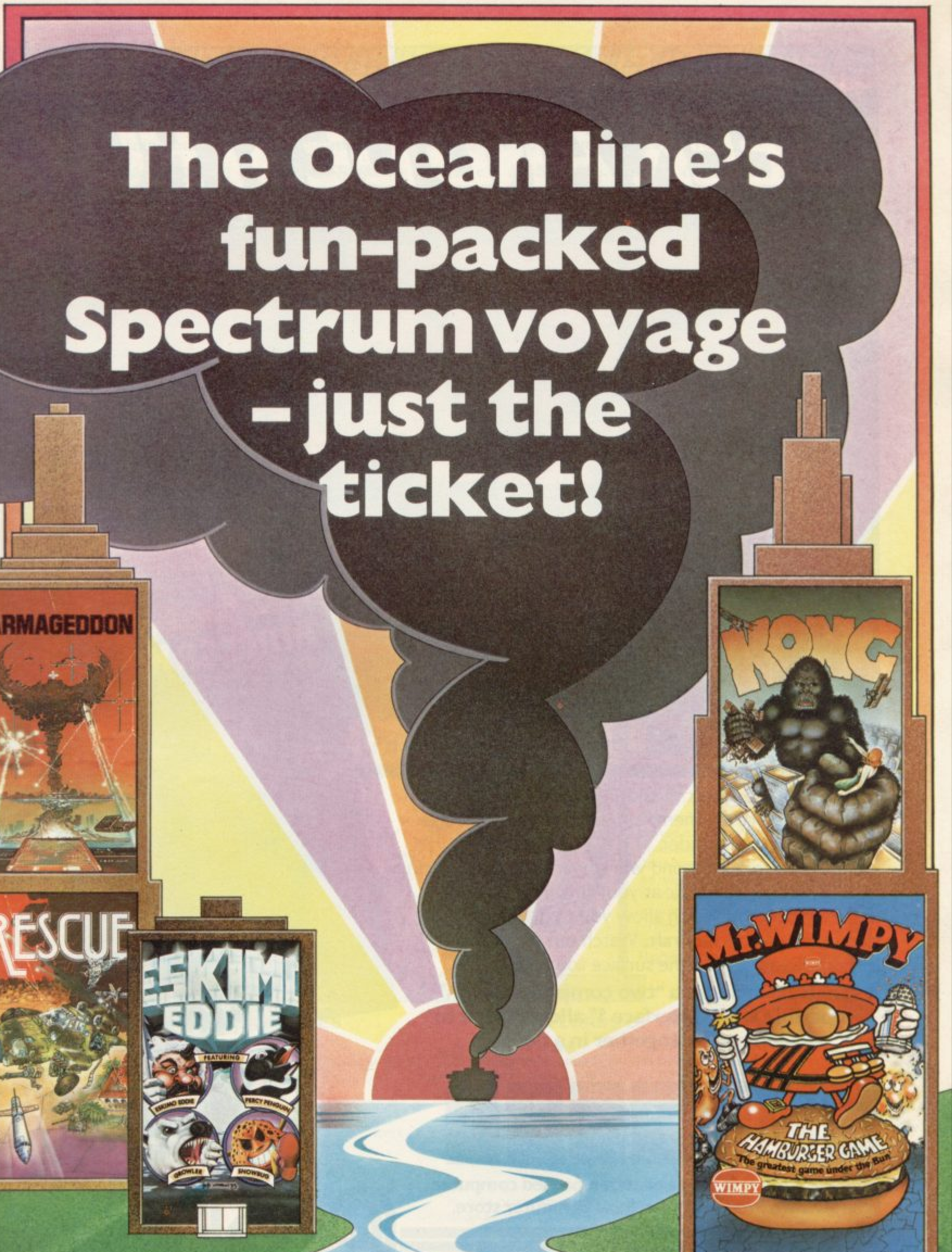
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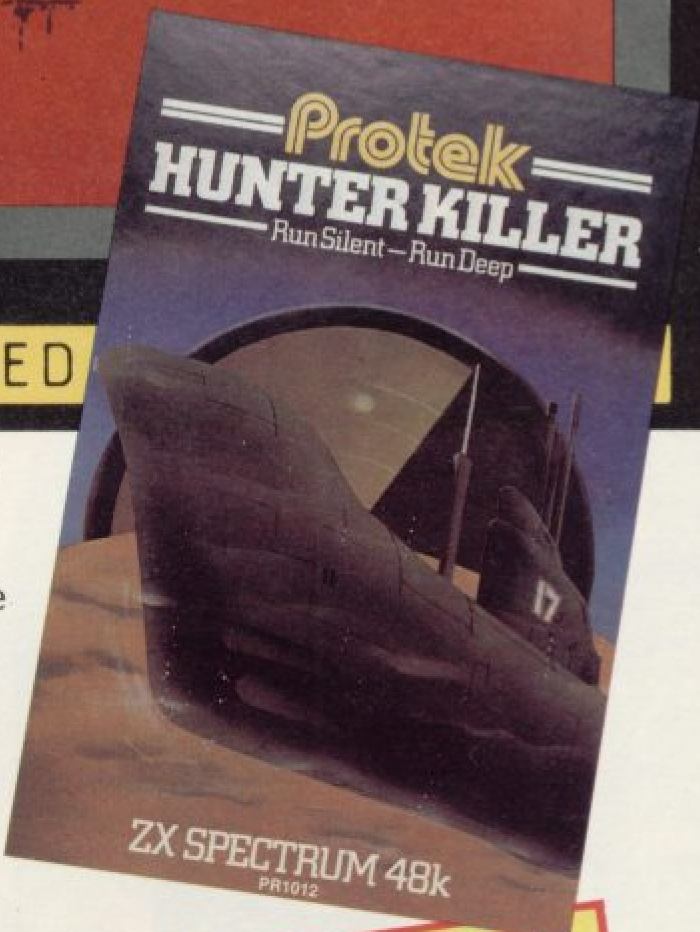
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This month's special offers will advance your knowledge of your machine

THIS MONTH the Club offers a range of software and books at greatly-reduced prices.

Golf will provide any keen golfer with a ZX-81 to play a hole or two with the computer. The game provides an accurate simulation with all the usual hazards. One or two players can play a round on a nine- or 18-hole course.

For Spectrum owners, **Star Trek** will provide one of the best versions of the original mainframe game, Play Captain Kirk and pilot the Enterprise in your search for Klingons. **Spectipede,** for the 16K Spectrum, is a faithful version of the old arcade game, Centipede. Destroy the segments of the centipede while avoiding the other creatures in the garden. All the software obtainable from the Club this month is from R and R Software.

A variety of books is also on offer. All of them are from Granada publications, which has proved to be one of the best computer and educational publishers in Britain.

Among the selection are one on machine code, written in easy-to-understand style, one on how to improve Spectrum graphics and sound and one for the educational user. If you want to play games, the *Spectrum Games Book* is for you and if you want to become an efficient programmer, *The Spectrum Programmer* might be just what you need.

All the offers will advance your knowledge of your machine. They can be obtained only by Club members and are available only until the end of April.

If you are not a member but intend to join this month, you can still take advantage of the books and software. Send an order form with your membership fee.

Chess games free to new members

IN THE JANUARY issue of *Sinclair User* we ran a special offer to attract female club membership. Every female who applied for membership was sent a free Mikro-Gen **ZX Chess** program for the ZX-81 or a Mikro-Gen **Masterchess** program for the Spectrum. The normal price for those programs is £6.95. The response was overwhelming and we received a number of letters from disgruntled males who felt that we were discriminating against them.

Consequently we decided to extend the offer to males and females for this issue only.

Everyone who applies to join the Sinclair User Club in April will receive one of the Mikro-Gen chess programs free, thus effectively reducing the club membership fee to only £5.

More than 400 club applications were received at the beginning of this year and that caused some members to experience delays of several weeks before receiving their membership cards and cassettes. We apologise to all concerned and assure members that we have taken steps to prevent a recurrence.

	List price	Offer price
ZX-81 Software		
Golf	£3.75	£2.99
Spectrum Software		
Star Trek	£3.75	£2.99
Spectipede	£4.95	£3.99
Books		
The ZX Spectrum and how to get the most from it	£5.95	£4.99
The Spectrum Programmer	£5.95	£4.99
The Spectrum Book of Games	£5.95	£4.99
Introducing Spectrum Machine Code	£7.95	£6.99
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Sinclair User Club

Britain

Aylesbury Computer Club: 12 Long Plough, Aston Clinton, Aylesbury, Bucks.

Aylesbury ZX Computer Club: Ken Knight, 22 Mount Street, Aylesbury (5181 or 630867). Meetings: first Wednesday and third Thursday of the month.

Basildon: Roundacre Microcomputer Users' Club. J Hazell, Basildon 285119/416333. Meetings every Wednesday 7.30 to 10.30pm.

Bristol Yate and Sodbury Computer Club: 99 Woodchester Yate, Bristol, BS17 4TX.

Cardiff ZX Club: Steve Smith (0222) 593237 or Mike Hayes (0222) 371732. Meets twice a month.

Colchester Sinclair User Group: Richard Lown, 102 Prettygate Road, Colchester CO3 4EE.

Crewe and Nantwich Computer Users' Club: J E A Symondson, 46 London Road, Stapeley, Nantwich, Cheshire CW5 7JL.

Doncaster and District Micro Club: John Woods, 60 Dundas Road, Wheatley, Doncaster DN2 4DR; (0302) 29357. Meetings held on second and fourth Wednesday of each month.

Eastwood Town Microcomputer Club: E N Ryan, 15 Queens Square, Eastwood, Nottingham NG16 3BJ.

Edinburgh: Edinburgh Home Computing Club. John Palmer (031 661 3183) or Iain Robertson (031 441 2361).

EZUG-Educational ZX-80-81 Users' Group: Eric Deeson, Highgate School, Birmingham B12 9DS.

Furness Computer Club: R J C Wade, 67 Sands Road, Ulverston, Cumbria (Ulverton 55068). Meets every other Wednesday.

Glasgow ZX-80-81 Users' Club: Ian Watt, 107 Greenwood Road, Clarkston, Glasgow G76 7LW (041 638 1241). Meetings: second and fourth Monday of each month.

Gloucester: Mid-weekly Spectrum User Group. Barry Ledbury, 8 Linnet Close, Gloucester GL4 9XA (0452) 23186.

Gravesend Computer Club: c/o The Extra Tuition Centre, 39 The Terrace, Gravesend, Kent DA12 2BA. Bi-monthly magazine and membership card.

Hassocks ZX Micro User Club, Sussex: Paul King (Hassocks 4530).

Inverclyde ZX-81 Users' Club: Robert Watt, 9 St. John's Road, Gourock, Renfrewshire PA19 1PL (Gourock 39967). Meets every other Monday at Greenock Society of the Deaf, Kelly Street, Greenock.

Keighley Computer Club: Colin Price, Redholt, Ingrow, Keighley (603133).

Lambeth Computer Club: Robert Barker, 54 Brixton Road, London SW9 6BS.

Liverpool ZX Club: Meetings every Wednesday 7pm at Youth Activities Centre. Belmont Road, Liverpool 6. Details from Keith Archer, 031-236 6109 (daytime).

Manchester Sinclair Users' Club: Meets every Wednesday, 7.30pm, at Longsight Library, 519 Stockport Road, Longsight — 061-225 6997 or 061 445 6316.

Meopham: National ZX Spectrum User Club. Guy Fullalove, Woodcotes, Camer Park, Meopham, Kent DA13 0XS. Bi-monthly newsletter, subscription £1.50. Send SAE for details.

Merseyside Co-op ZX Users' Group: Keith Driscoll, 53 Melville Road, Bootle, Merseyside L20 6NE; 051-922 3163.

Micro Users' Group: 316 Kingston Road, Ewell, Surrey KT19 0SY.

Newcastle (Staffs) Computer Club: Meetings at Newcastle Youth and Adult Centre, Thursday, 7.30 to 10 pm. Further information from R G Martin (0782 62065).

North Hertfordshire Home Computer Club: R Crutchfield, 2 Durham Road, Stevenage; Meetings: first Friday of the month at the Settlement, Nevells Road, Letchworth.

Northern Ireland Sinclair Users' Club: P Gibson, 11 Fitzjames Park, Newtownards, Co Down BT23 4BU.

North London Hobby Computer Club: ZX users' group meets at North London Polytechnic, Holloway Road, London N7 Monday, 6pm.

Nottingham Microcomputer Club: ZX-80-81 users' group, G E Basford, 9 Holme Close, The Pastures, Woodborough, Nottingham.

Orpington Computer Club: Roger Pyatt, 23 Arundel Drive, Orpington, Kent (Orpington 20281).

Perth and District Amateur Computer Society: Alastair MacPherson, 154 Oakbank Road, Perth PH1 1HA (29633). Meetings: third Tuesday of each month at Hunters Lodge Motel, Bankfoot.

Regis Amateur Microcomputer Society: R H Wallis, 22 Mallard Crescent, Pagham, Bognor Regis, West Sussex PO21 4UU.

Roche Computer Club: 8 Victoria Road, Coop Rooms, Roche, Cornwall: 0726 890473.

Scunthorpe ZX Club: C P Hazleton, 26 Rilestone Place, Bottesford, Scunthorpe; (0724 63466).

Sheffield: South Yorkshire Personal Computing Group. Enquiries to R Alderton (0742 20571), S Gray (0742 351440), P Sanderson (0742 351895).

Sittingbourne: Anurag Vidyarth (0795 73149). Would be interested to hear from anyone who wants to start a club near the Medway towns.

St Albans: Bi-monthly meetings and a magazine. Details from Adam Slater, 40 Watford Road, St Albans, Herts AL1 2HA. (0727 54176).

Stratford-on-Avon Computer Club: Meets on the second Wednesday of every month. Telephone: 0789 68080 for details.

Swansea Computer Club: B J Candy, Jr Gorlau, Killay, Swansea (203811).

Swindon ZX Computer Club: Andrew Bartlett, 47 Grosvenor Road, Swindon, Wilts SN1 4LT; (0793) 3077. Monthly meetings and library.

Sutton: Sutton Library Computer Club, D Wilkins, 22 Chestnut Court, Mulgrave Road, Sutton, Surrey SM2 6LR.

West Sussex: Midhurst and District Computer User Group. Enquiries to V Weston (073 081 3876), R Armes (073 081 3279).

Worle Computer Club: S W Rabone, 18 Castle Road, Worle, Weston-super-Mare BS22 9JW (Weston-super-Mare 513068). Meetings: Woodsprings Inn, Worle, on alternate Mondays.

ZX-Aid: Conrad Roe, 25 Cherry Tree Avenue, Walsall WS5 4LH. Please include sae. Meetings twice monthly.

ZX-80/ZX-81 Users' Club: PO Box 159, Kingston-on-Thames. A postal club.

Overseas

Austria: ZX User Club, Thomas Christian, c/o Wissenschaft Forscht e. V., Postfach 141, A1190 Vienna. Meets every first Friday of the month. Telephone 0222-44 32 050 for details.

Belgium, France and Luxembourg: Club Micro-Europe, Raymond Betz, 38 Chemin du Moulin 38, B-1328 Ohain, Belgium (32/2/6537468).

Denmark: Danmarks National ZX-8081 Klub (DNZK), Jens Larson, Skovmosevej 6.4200 Slagelese, post giro 1 46 24 66.

ZZ-Brugergruppen i Danmark, Boks 44, 2650 Hvidovre, Gratis medlemskab og gratis blad til enhver interesseret.

J Niels-Erik Hartmann, OZ-ZX-Radioamator, Bruger Gruppe, Bredgade 25 DK-4900, Nakskov.

East Netherlands: Jonathon Meyer, Van Spaen Straat 22,6524 H.N. Nijmegen; (080 223411).

Germany: ZX Club, a postal club; contact Aribert Deckers, Postfach 967, D-7000 Stuttgart 1, West Germany.

Indonesia: Jakarta ZX-80/81 Users' Club, J S Wijaya, PO Box 20, Jkukg, Jakarta, Utara, Indonesia.

Irish Amateur Computer Club: Martin Stapleton, 48 Seacourt, Clontarf, Dublin 3. (331304).

Irish Sinclair Users Club: PO Box 1238, Dublin 1. Publishes a newsletter. Send SAE for details.

Italy: Sinclair Club, Via Molino Vecchio 10/F, 40026 Imola, Italy.

Genova Sinclair Club; Vittorio Gioia, Via F Corridoni, 2-1, telephone 010 3125 51.

Micro-Europe: Belgium or Club Paris-Micro, 19 Rue de Tilly, 92700, Colombes, France; associated with Club Micro-Europe.

Republic of Ireland: Irish ZX-8081 Users' Club, 73 Cnoc Crionain, Baile Atha, Cliath 1.

Singapore: Sinclair Users' Group: Eric Mortimer, 1D Wilmer Court, Leonie Hill Road, Singapore.

South Africa: Johannesburg ZX-80-81 Computer Users' Club: S Lucas, c/o Hoechst SA (Pty) Ltd, PO Box 8692, Johannesburg.

Johannesburg ZX Users' Club: Lennert E R Fisher, PO Box 61446, Marshallstown, Johannesburg.

Dumont and Syndercombe Amateur Computer Club. Jean-Pierre Dumont would like to correspond with ZX-81 owners via tapes. Write to 8 Kipling Road, Farrarmere, Benoni 1500, Transvaal.

Spain: Club Nacional de Usuarios del ZX-81, Joseph-Oriol Tomas, Avda. de Madrid, No 203 207, 10, 3a esc. A Barcelona-14 Espana. International ZX Spectrum Club: Gabriel Indalecio Cano, Sardana, 4 atrico 2a, San Andres de la Barca, Barcelona. Send international reply coupon. Produces a bi-monthly magazine. Spanish ZX Micro Club: Apartado 181, Alicante (Costa Blanca), Spain.

ZX Club Spain; C Benito PO Box 3253, Madrid, Spain.

Swedish ZX-club: Sinclair Datorklubben, Box 1007, S-122, 22 Enskede, Sweden.

United States: Bay Area ZX-80 User Group, 2660 Las Aromas, Oakland CA94611.—Harvard Group, Bolton Road, Harvard MA 01451: (617 456 3967).

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- Each Trickstick comes with its own interface included in the price.
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- Works with most Kempston compatible software, and with our new programmable adaptor (£10 for Trickstick owners) it works with ANY software.
- Easy to program, even for proportional games.
- In the shops soon. Now available by mail / telephone order at £34.50.

TRICKSTICK-
The revolution that Runs Rings round ordinary joysticks

THE 80k SPECTRUM – £57.50

Upgrade your 16k Spectrum to a full 80k with the SP80 – a 64k expansion kit giving two 32k pages above address 32767. Not recommended for beginners, but ideal for the serious programmer. Pages are switched using software instructions only, and an LED indicates which page you are on. The other page is isolated from the system, but retains all its information until switched back.

The SP80 simply plugs into the sockets in the 16k Spectrum. Full fitting instructions are provided. It is easy to fit and no soldering is required.

See 48/80 FORTH for another angle.

48|80 FORTH

48/80 FORTH – £14.95

The latest, best and most complete version of this popular language for the Spectrum FORTH runs many times faster than machine code; – a tonic if you're fed up with all those GOTOs.

Each tape includes both a 48k version and an 80k version (for use on Spectrums upgraded with our SP80. SP48 owners are offered a part-exchange price of £18 if they upgrade to 80k).

The manual provides both the normal technical definitions of the language, and an outstanding brief introduction for the beginner. Each tape also includes a superb EDITOR program to give you full control of the 16 (48k) or 32 (80k) disk screens.

A FORTH Toolkit (giving floating point etc) and an extension for the Microdrive will be available shortly. 48/80 FORTH uses standard FIG-FORTH definitions with extensions to exploit the special characteristics of the Spectrum, including BEEP (for real arcade quality sound), DRAW, PLOT and CIRCLE.

BEYOND HORIZONS – £4.50

This teaching program has already made computing less mysterious for thousands of people. It guides you through the Spectrum 48k memory, teaches you to PEEK and POKE systems variables, shows you how the display file and colour attributes work, how a BASIC program is stored byte by byte, and much much more. Outstanding value for those who get stuck on the second half of the Spectrum manual.

SP48

UPGRADE YOUR ISSUE 2 OR 3 SPECTRUM FOR JUST £23 AND GET A £4.50 COPY OF BEYOND HORIZONS ABSOLUTELY FREE

The SP48 simply plugs into the sockets provided by Sinclair in your Spectrum. Easy to fit, full instructions provided and no soldering. Fits both Issue 2 and Issue 3 machines and gives you a standard 48k Spectrum. And no other expansion kit allows you to upgrade later to the 80k Spectrum. Over 20,000 16k Spectrum owners have already upgraded with the SP48. Join them.

And you get a free copy of BEYOND HORIZONS, so there's yet another angle to look at.

____ **Trickstick £34.50**	
____ **Attaktics £10.00**	
____ SP48 (Issues 2 & 3 **£23**	
____ SP80 **£57.50** (Please specify which Issue)	
____ 48/80 FORTH **£14.95**	
____ Beyond Horizons **£4.50**	
____ Programmable Interface **£10** (with Trickstick)	
Postage **£0.65**	**0.65**
I enclose cheque/PO for	

My Access/Visa number is

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SU4

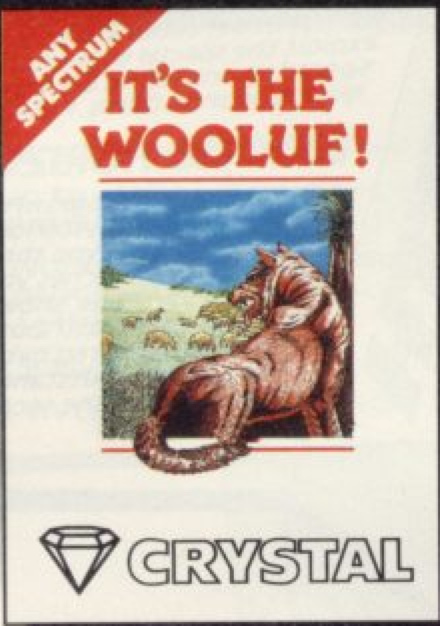
East London Robotics Ltd., Gate 11, Royal Albert Dock, London E16
24 Hour Access and Visa ordering 01-474 4430

EAST LONDON ROBOTICS

TWO NEW RELEASES FROM CRYSTAL

IT'S THE WOOLUF!

TUBE WAY ARMY



Written by: Martin Buller



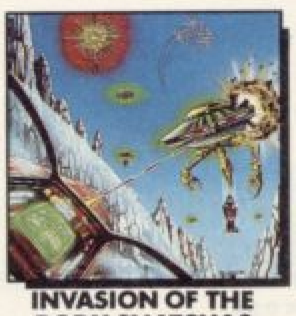
Written by: Rainbow Software

From the creators of 'Halls of the Things,' 'Invasion of the body snatchas,'
and many other software classics come these exciting new games.
Games to tax your judgement and puzzle and frustrate you for months on end.
Don't forget our other titles, which have attracted enthusiastic reviews like
"Spectacular, one of the best games I've seen"... POPULAR COMPUTING WEEKLY and
"Excellent, dangerously addictive, could change the Spectrum games scene overnight"... SINCLAIR USER.

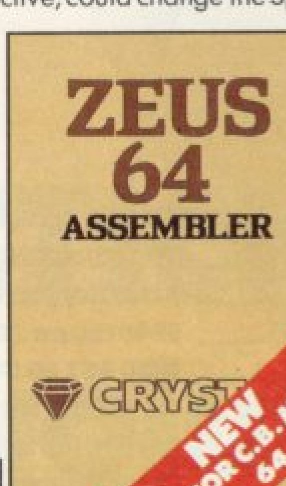
COMING SOON RETURN OF THE THINGS



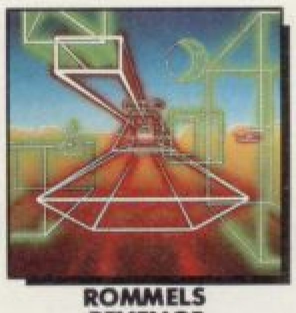
HALLS OF THE THINGS
Written by: Neil Mottershead, Simon Brattel and Martin Horsley



INVASION OF THE BODY SNATCHAS
Written by: Simon Brattel and Neil Mottershead



Written by: Graham Stafford



ROMMELS REVENGE
Written by: Martin Horsley



THE DUNGEON MASTER
Written by: Graham Stafford

All titles for 48K Spectrum unless otherwise stated

PROGRAMMERS! WRITTEN ANY SOFTWARE THAT COMES UP TO OUR STANDARDS? IF SO SEND IT TO US FOR EVALUATION. WE OFFER GENEROUS ROYALTIES.

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CRYSTAL COMPUTING IS THE TRADING NAME OF CHANDREX LTD.
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Please supply:

INVASION OF THE BODY SNATCHAS	☐	**£6.50**
HALLS OF THE THINGS	☐	**£7.50**
THE DUNGEON MASTER	☐	**£7.50**
IT'S THE WOOLUF	☐	**£6.50**
ROMMELS REVENGE	☐	**£6.50**
TUBE WAY ARMY	☐	**£7.50**
ZEUS 64	☐	**£9.95**
CATALOGUE OF LATEST SOFTWARE	☐	

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I enclose cheque/p.o. for ....
P & P included. Overseas orders, please add £1.50 per item.

SU4

Awards for top Spectrum games

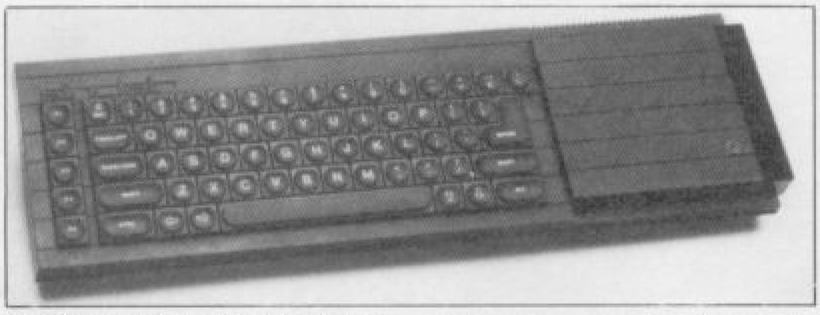
THE GOLDEN Joystick Awards, sponsored by *Computer and Video Games,* have been presented to computer companies which, in the opinion of its readers, produced the best arcade or strategy games in 1983. All the winning games were for the Spectrum.

The prizes were presented by disc jockey Dave Lee Travis, who is a games addict. Game of the Year was **Jet-Pac** and its manufacturer, Ultimate Play the Game, was also voted Software House of the Year. **Ah Diddums,** from Imagine, was the best original game of 1983. In the specific categories **Manic Miner,** formerly of Bug-Byte, was voted Arcade Game of the Year and **The Hobbit** became Best Strategy Game of the Year.

Some confusion marked the award of the prize for best arcade game. The author of Manic Miner is no longer with Bug-Byte and Software Projects, a new company, has taken over manufacture and sale of the product.

Eugene Lacy, assistant editor of *Computer and Video Games,* was pleased with the response from readers. He said that he hopes the Golden Joystick Awards will become an annual event.

QL demand likely to cause delays



SINCLAIR RESEARCH admits that it might have difficulty keeping to the 28-day period specified on its order forms because of incredible demand for the new QL. A spokesman for the company says:

"We have had something like 500 to 600 orders every day, so we are beginning to think about delivery problems and how to avoid them."

In the meantime, the launch of the Sinclair QL appears to have been timed to coincide with the fact that the contract for the BBC computer programme, Making the Most of your Micro, is due for renewal later this year. John Radcliffe, executive producer of the BBC programme, says:

"Several proposals are being discussed and the appearance of a new generation of Sinclair computers is certainly timely."

The QL will probably have a hard struggle to outweigh the advantage already gained by the Acorn BBC Model B. "We would obviously find it much easier to stay with the computer we already have," says John Harrison of BBC Enterprises, "but many developments have taken place in micro technology since we signed the original contract with Acorn almost three years ago, and certain changes would be needed if we were to renew the contract with Acorn."

A final decision on the winner of the new contract seems likely soon.

Giant showroom opens

A NEW SHOP described as the world's biggest computer store has been opened by Steiger at Stonebridge Park on the North Circular Road, London. Covering 100,000 sq. ft. the open-plan showroom will stock all the leading makes of business and home computers, as well as software and peripherals. Customers will also be able to obtain advice on specific applications and order programs tailored to their needs.

"The idea is to enable a customer to walk in and find a complete system for any particular purpose," says Steiger general manager John Patterson. Steiger plans to follow the new store with a network of 'mother shops' and 'satellite shops' all over the country. Four stores are scheduled to open this year in Berkshire and the Greater London area.

Piracy fears renewed

A NEW tape magazine, from Qadan Software of Abu Dhabi, has produced a storm of protest from software companies in Britain and renewed fears of software piracy.

QCC is a magazine for the Spectrum. The difficulty is that it seems to contain games produced by British companies, including Jet-Pac, Arcadia and Astroblaster.

Imagine Software, manufacturer of the best-selling game Arcadia, has made it clear to British magazines featuring QCC advertisements it will cease all advertising with them if the Qadan advertisements continue. The company plans to prevent the tapes reaching Britain.

Another software house concerned about QCC is Quicksilva, as Astroblaster, another best-seller, is on the magazine contents list. Mark Eyles, a spokesman for the company, says: "We are looking at the situation closely and are trying to obtain a copy of the magazine.

Concern over closure

COMPUTERS FOR ALL, independent distributor of computer products including software and hardware for Sinclair machines, has ceased trading and is likely to go into liquidation. The demise of the company happens at a bad time for wholesalers who have supplied goods to CFA and have received no payment in return.

One such company is Prism Microproducts, an associate of ECC Publications which publishes *Sinclair User.* Prism has delivered a large quantity of Spectrums and is owed what is believed to be a considerable amount.

Computers For All made a name for itself during the latter part of 1983 when it appeared as a major exhibitor at various large computer shows. At that time the company had more than 50 dealers throughout the country which used its name in their shops. Now many of those shops are short of computers and software.

Another group to suffer is the consumers who have had to return faulty merchandise. Customers are concerned that those computers will not be repaired and that the machines may not be returned.

Microdrive sales in full swing

THE SINCLAIR Microdrive should be on sale through retail outlets, including W H Smith, in the near future. The original mail order list was completed in early February and from then Sinclair moved to the subsidiary list which consisted of people who had asked to be put on the mail order queue when the Microdrive was in 'closed season'.

The take-up on the original list was approximately 30 percent, which was better than expected. The figure the company was hoping to reach was 10 percent.

Another surprise for Sinclair is the number of people who ordered an Interface One without Microdrives but, on average, each person who has ordered an Interface One has also bought one-and-a-half Microdrive cartridges.

Sinclair Research is hoping to complete orders on the subsidiary list quickly. A spokesman says: "The speed with which we can deal with them depends on how many place orders."

The good news for customers is that they can telephone Sinclair Research and order a Microdrive or Interface at any time. For some time, however, the orders will be dealt with by mail order only.

Spectrum selected for TV cable system

BY THE END of this year, one-and-a-half million households will be able to play professional Spectrum software transmitted on the existing cable television system, on computers hired for less than £10 a month.

Cable Interactive Services, a sub-division of British Telecom, has developed the system, Gamestar, and hopes to sign contracts with the various companies which already have licensed cable networks.

Subscribers to Gamestar will pay £9.95 per month for 12 months and for that they will receive a 48K Spectrum and a joystick, together with a black box which downloads the software from the television. Each month 20 games will be broadcast and the games will be changed at the rate of five a month, thus providing subscribers with 75 games a year.

"The games will cover the entire range of Spectrum software, from current chart-toppers to golden oldies," says Trevor Havelock of Cable Interactive Services. The games will be professional software from leading software houses and will be supplied by Micronet.

Copying of games by hackers will be made as difficult as possible.

In addition to the million-and-a-half households which already have cable television, another 900,000 are due to receive cable in 1985, through the 11 franchises licensed by the Government.

W H Smith has developed a similar games network for cable transmission but has opted for an American system which uses a custom-built terminal and joystick, the software for which is available only in the States.

Why was the Spectrum chosen for Gamestar? Havelock is unequivocal. "The Spectrum is far and away the most popular machine, with a software base second to none," he says.



The Sinclair Research computer centre in Willis Road, Cambridge, has won a major commendation from the Business and Industry panel for the Environmental Award 1984. Built at a cost of £750,000, the complex combines traditional design with major technical innovations. A restored L-shaped building houses the offices and research laboratories, while the glass-covered atrium provides a microprocessor-controlled solar energy system for heating and lighting the complex. An original well has been adapted to provide water at a constant 12 degrees Centigrade.

Best prize

PANIC, an arcade-type game written by Nicholas Best of Bristol, won the prize for the best Spectrum program in the *Sinclair User* Christmas competition. He receives an East London Robotics Trickstick and a games cassette.

The winner in the 16K ZX-81 category was Peter Dziwior of South Croydon. His entry was an extremely fast and professional program, **Formula One.** The winning 1K ZX-81 games was **Sweetshop,** an original simulation submitted by J Lowther of Heywood, Lancashire. Both winners receive a DDC colour interface.

The listing for Sweetshop can be found in Program Printout.

More news on page 20

Computer Snowman

QUICKSILVA has produced a game for the 48K Spectrum based on a book by the best-selling children's author, Raymond Briggs. Called **The Snowman,** the game features a little boy trying to build a snowman in spite of gas flames which melt the snow he has collected and sleep monsters which send him back to bed.

"We had been thinking of doing a game based on *The Snowman* for some time," says Quicksilva director Mark Eyles.

Briggs, who has no computer, contributed only the broad outline of the story. "We agreed from the start that there was to be no violence in the game." Although he does not play the game, he approves of the final result and hopes the game may lead to further collaboration with Quicksilva.

"There has been talk of basing another game on my book, *Fungus the Bogeyman,* he says. "I think that might lend itself even better to being played than *The Snowman* does."

Quicksilva comments that any such product will depend on how successful The Snowman proves to be.

Timex/Sinclair success

THE Timex/Sinclair 2068 has been selling well in the States, despite reports that Timex has had difficulty with the new computer.

The machine, which includes a ROM cartridge port and an RS232 interface, has been described as an upgrade of the Spectrum and has a bigger and more manageable keyboard. Better graphics facilities include the option of an 80-column screen for word processing.

Unfortunately, because of contractual obligations with Sinclair Research, the computer cannot be sold in Europe. Neither does Sinclair expect to manufacture a computer like the 2068 in the U.K. A spokesman for the company says: "If we were to consider such a move we would produce a machine with our own technology."

Timex expects the 2068 to do even better in the summer when it releases a new range of peripherals. The machine already has a communications modem and printer.

QL to star at ZX Microfair

THE NEXT ZX Microfair is to be held at Alexandra Palace, London, on April 28. Promised as the star attraction is a working model of the new Sinclair QL computer.

Advance tickets for the April Microfair can be obtained from Mike Johnston, 71 Park Lane, London N17 0H6. They cost £1 for adults, 50 pence for children. Price at the door, £1.25.

Backlog cleared

THE FULLER FDS keyboard for the Spectrum is now available and the backlog of orders was cleared by the end of February, claims Roy Backhouse, managing director of Fuller.

Fuller has installed a new production line and a telephone hot-line for customer queries — 051-709 9280.

More than 50 complaints were received at *Sinclair User* in December and January, concerned with overdue delivery and the lack of acknowledgment. Some customers were invoiced for a price increase and additional postage.

Fuller is apparently producing 1,000 keyboards a week, with a 21-day turnround on orders.

Multi-tasking ZX-81 popular

THE MINISTRY of Defence, universities, hospitals and industry have discovered the potential of the ZX-81. With a little help from David Husband of Skywave Software, the ZX-81 has been adapted to multi-tasking by adding a ROM which changes the language from Basic to Forth.

The ZX-81 thus becomes a powerful industrial controller, capable of running more than 10 tasks simultaneously.

Working from his home at Poole, Husband has built a large turnover which he expects to exceed £1 million in 1984.

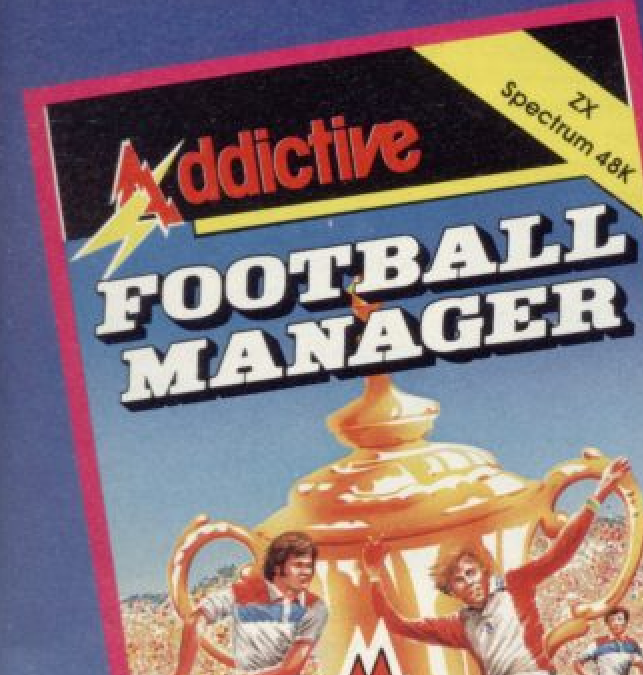
More than half his customers are companies and organisations and the medical profession has been specially interested.

The ZX-81 Forth ROM costs £25 plus VAT and is available from Skywave Software. Tel: 0202 302385.



ZX81 16K, ZX Spectrum 48K†
BBC and Oric versions coming soon!

The No. 1* Football Game



Football Manager

Designed by Kevin Toms

This outstanding game of skill and strategy is now widely available and you can join the many thousands of satisfied customers who have purchased the game. This is no five minute wonder – you will be playing this game for hours over many weeks (we know – our customers tell us!).



Kevin Toms

Some of the features of the game:–

- ★ Matches in 3D graphics ★ Transfer market
- ★ Promotion and relegation ★ F.A. Cup matches
- ★ Injury problems ★ Full league tables
- ★ Four Divisions ★ Pick your own team for each match
- ★ As many seasons as you like
- ★ Managerial rating
- ★ 7 skill levels
- ★ Save game facility

Addictive

*ZX81 Chart, Home Computing Weekly 16.8.83

Programmers
We want your software. Send us a sample, if accepted, we will supply generous royalties plus cash advances plus free advice from Kevin himself!

Comments about the game from press and our customers

"FOOTBALL MANAGER is the best game I have yet seen on the Spectrum and my personal favourite of all the games on any micro ... To the ordinary person it is an excellent view of what can be done in the field of computer games ... The crowning glory of this game is the short set pieces of match highlights which show little stick men running around a pitch, shooting, defending and scoring ... It is a compulsive game but people who cannot take game sessions of 9 hours or so, which happened on one happy Sunday, will be grateful to know that there is a 'save to tape' option. FOOTBALL MANAGER has everything it could ... The originator, Addictive Games, certainly deserve the name." Rating: 19/20 (Practical Computing – August 1983).

"When I first received this game I spent the best part of the weekend playing it. Since then I have returned to it more often than any other. The truly addictive quality of this game is the remarkable way it mirrors the real football manager's problems ... "(Personal Computer Games – Summer 1983)

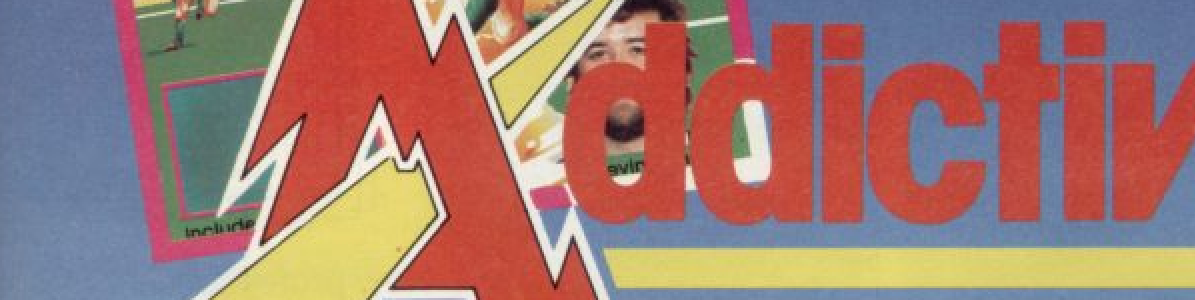
"It's my own fault you *did* warn me – I am totally and completely hooked on FOOTBALL MANAGER." (Mr. A. Wright – Lancashire.)

"It is by far the best software game that I have seen for the Spectrum." (Mr. N. Lincoln – Surrey.)

"I congratulate you for a marvellous game which keeps the player enthralled." (Mr. N. Creasey – Gerrard's Cross.)

"I am writing to say what a great game it is. I have spent over 45 hours on it." (Mr. D. Fearn – Gloucestershire.)

"Your FOOTBALL MANAGER game is terrific." (Mr. N. Cumming – West Bromwich.)



Action from the Spectrum version

Available from computer software stockists nationwide, including Boots & WHSMITH

† Spectrum version only

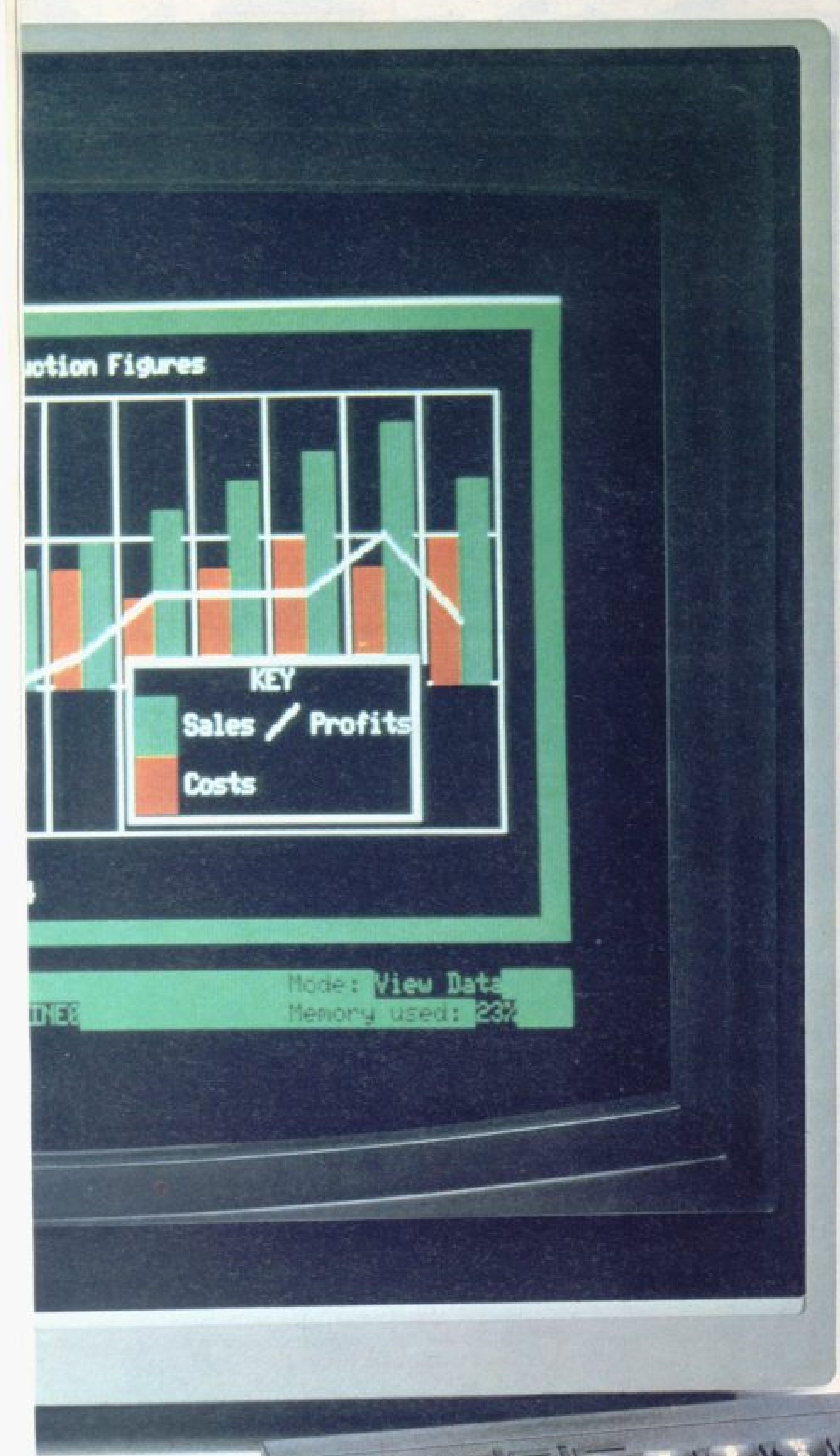
Prices: Spectrum 48K £6.95
ZX81 16K £5.95
(N.B. 3D GRAPHICS ARE NOT INCLUDED IN THE ZX81 VERSION).
Overseas orders add £1·50

To order by mail (p&p free) send cheques or postal orders to:

Addictive Games
Albert House, Albert Road, Bournemouth BH1 1BZ.

Dealers! For urgent stocks send your headed notepaper direct to our address.

New-Sinclair QL
There's no comparison chart, b



The Sinclair QL is a new computer.

Not just a new Sinclair computer, but a totally new sort of computer – nothing like it exists anywhere.

It's not just a bit better than this, or a bit cheaper than that – it's a computer that's very hard to compare with anything. Just check the features below – and if you don't agree, take up the challenge at the end of the advertisement.

If you do agree, there's only one course of action you can take… get yourself a Sinclair QL at the earliest possible moment.

The Sinclair QL has 128K RAM. Big deal?

Several micros offer 128K RAM, or more, as standard. The 'What Micro?' table for December 1983 lists over 50 of them – but 40 of the 50 micros listed cost over £2,500!

The Sinclair QL offers you 128K RAM for under £400, and an option to expand to 640K. That's a lot of bytes to the pound!

The Sinclair QL has a 32-bit processor. Who else?

Under £2,700, nobody. Even the new generation of business computers, such as the IBM PC, are only now beginning to use 16-bit processors.

At prices like this, the Motorola 68000 family – widely regarded as the most powerful microprocessors available – will remain a luxury.

Yet with the Sinclair QL, the 32-bit Motorola 68008 is available for less than £400.

You can also be sure that the QL will not become outdated. 32-bit architecture is future-proof.

32-bit processor architecture, 128K RAM, and QDOS combine to give the QL the performance of a mini-computer for the price of a micro.

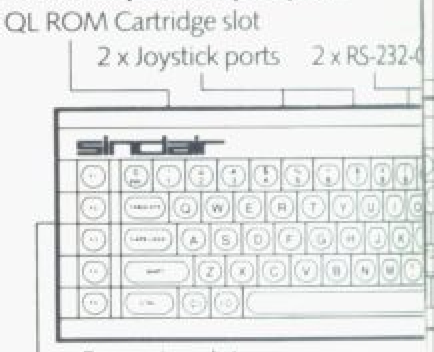
Exclusive: new QDOS operating system

No competition! QDOS sets a new standard in operating systems for the 68000 family of processors, and may well become the industry standard.

QDOS is a single-user, multi-tasking, time-sliced system using Sinclair's new SuperBASIC as a command language.

One of its most significant features is its very powerful multi-tasking capability – the ability to run several programs individually and simultaneously. It can also display the results simultaneously in different portions of the screen. These are features not normally available on computers costing less than £7,000.

Eleven input/output ports

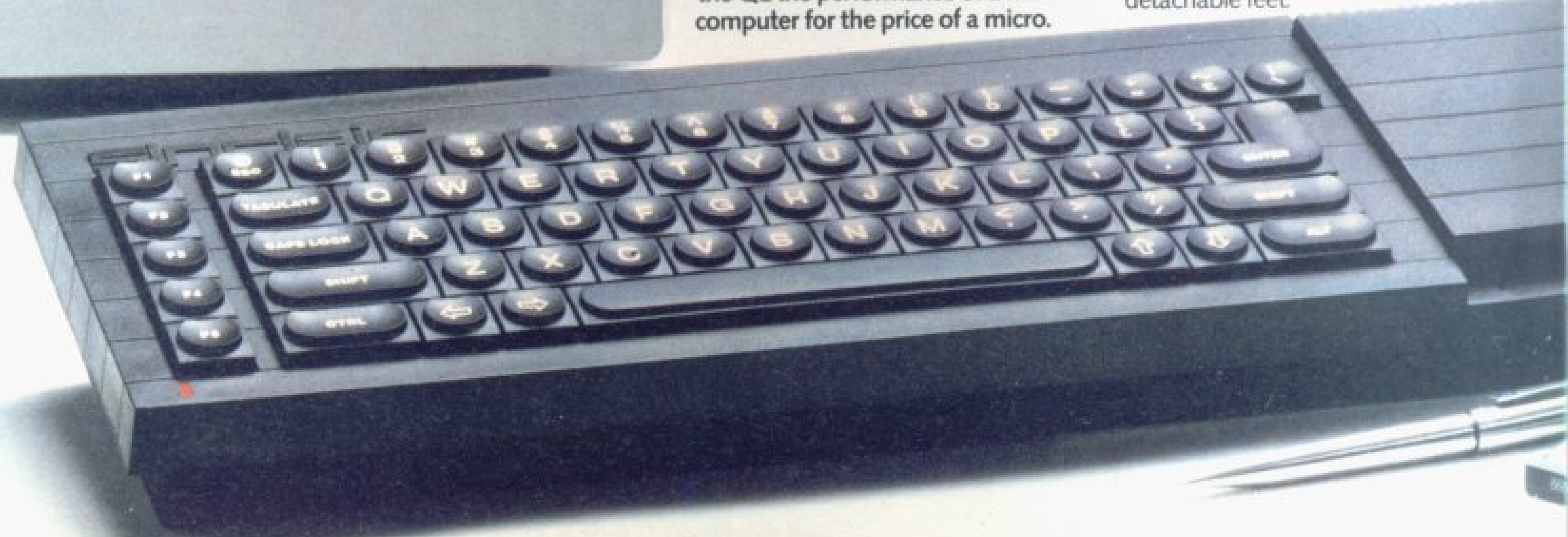


New professional keyboard

The QL keyboard is designed for fast input of data and programs.

It is a full-size QWERTY keyboard, with 65 keys, including a space bar; left-and right-hand shift keys; five function keys; and four separate cursor-control keys – key action is positive and precise

A membrane beneath the keyboard protects the machine from dust (and coffee!), and for users who find an angled keyboard more comfortable, the computer can be raised slightly at the back by small detachable feet.



fantasy SOFTWARE

The battle could be yours.....
.....but it won't be easy!



This is 'ZIGGY', shown above, in his exploratory capsule and is a true representation of the on-screen graphics.

THE PYRAMID

THE PYRAMID is an arcade style game which has a very adventurous feel to it.

The Pyramid contains 120 chambers on 15 levels. In order to get from one chamber to another you must fight off the indigenous aliens to collect an energised crystal which will neutralize the force field guarding the two exits.

The Pyramid is inhabited by a total of 60 weird and exotic alien types, all of which are beautifully animated. You will meet a whole variety of demons, droids, insects and monsters, with a sprinkling of the more unusual, the extra-terrestrial tweezers, galactic strawberry, cosmic claw, mutant eye, plus a whole host of entities that defy rational description. You'll no doubt invent your own nicknames.

You proceed to explore the pyramid from top to bottom with the difficulty generally increasing with the depth of level. Depending on the choice of exit from each chamber you are likely to have a different game every time you play.

Apart from the challenge of trying to achieve the highest score possible the pyramid contains a number puzzle to solve. The more chambers you successfully visit the more information is gathered to enable you to discover the secret numbers of the pyramid. The puzzle won't take you days to solve, it will probably take you a few months.

DOOMSDAY CASTLE

DOOMSDAY CASTLE consists of a labyrinth of 74 complexly inter-connected Halls and Passages where you will meet a whole host of adversaries serving the infinitely evil Scarthax, the Garthrogs, the Orphacs, the phenomenally nasty Googly Bird and the Urks which manifest themselves in over fifty unbelievably weird and wonderful guises.

Scarthax has scoured the Universe to bring together the six ancient stones of lifeforce. United in Doomsday Castle they are being used to wield an irresistable power over the cosmos, emanating waves of corruption through every galaxy.

To save the Universe, you must battle your way through the Castle to find and collect the six stones and use their force against Scarthax to destroy Doomsday Castle, hopefully escaping yourself before the final cataclysmic explosion.

The task is not easy (saving the Universe never is!) and it will take you many games to unfold the structure of Doomsday Castle and discover the locations of the ancient stones.

The addictive arcade style action will keep you coming back to play but the overall challenge should still keep you occupied for months.

FANTASY SOFTWARE is available from W.H.SMITHS, JOHN MENZIES, BOOTS, LASKYS, GREENS, RUMBELOWS, SPECTRUM GROUP, COMPUTERS FOR ALL and all other good software retailers.

The Pyramid at £5.50 and Doomsday Castle at £6.50 from

FANTASY SOFTWARE, FALCONBERG LODGE, 27A ST GEORGES ROAD, CHELTENHAM, GLOS GL50 3DT
despatched by return first class post together with free membership and current newsletter of the Fantasy Micro Club.
Trade Enquiries welcome – telephone 0242-583661.

Poor service from Sinclair?

JOHN KERRIGAN'S article in the January issue is the nearest I have seen to a reasonable explanation of what the Spectrum ROM does with the display file but would it not be better to demonstrate the way in which the file handles pixels? The article assumes the reader to have a reasonable knowledge of Basic so that it can be used to show scans in a very easy-to-follow way, as I hope the following short programs will demonstrate. It means that you should ignore the advice in the Sinclair manual, page 164, not to POKE into the display file.

All the programs are variations on the same theme. They are best RUN in the order shown. The PAUSEs are simply to slow the action. The only explanation needed is that POKEing 255 into a display file address inserts eight pixels per character position/scan — one for each bit position — and 129 places a pixel in the MSBit and LSBit of a byte.

Now for a complaint about the continuing poor service offered by the Sinclair organisation. I do not buy games software, nor do I buy any software which I can easily develop myself. The exception was the cassette being offered by Sinclair mail order explaining the latest microchip technology. As I used to dabble in electronics some years ago and possess some reasonable test equipment, I thought that the cassette would offer a useful update of knowledge. Accordingly I ordered the cassette in November. A card arrived postmarked December 5 saying my order was being processed.

Later my Barclaycard statement showed that I had been charged for the cassette and as I was in credit with the company it meant that I had already paid for an item which had not been delivered. When I telephoned Sinclair I was told to call back in a week if the item had still not arrived. Is it any wonder that the Japanese make inroads rapidly into the British market? In case there is complacency about the rest of Europe, let me warn the industry that the French are already catching up and have their own cheap micro on sale.

R G Urquhart, Romford, Essex.

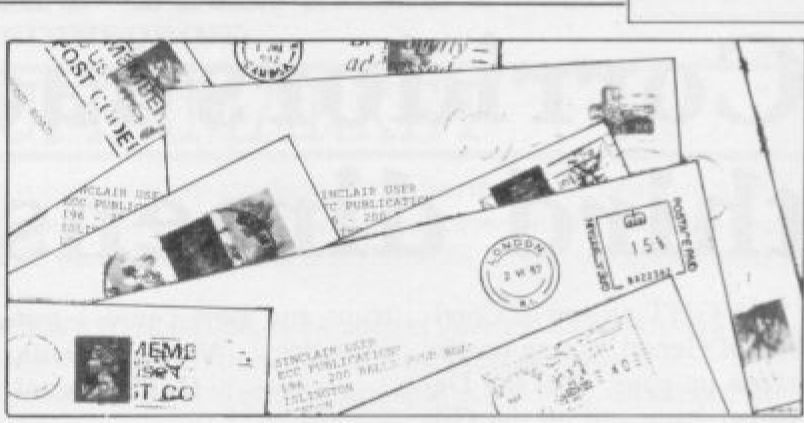
```
10 FOR r=0 TO 6143
20 POKE 16384+r,255
30 PAUSE 2
40 NEXT r

10 FOR r=0 TO 6143 STEP 32
20 POKE 16390+r,129
30 NEXT r

10 FOR r=0 TO 6143 STEP 32
20 POKE 16390+r,255
30 PAUSE 5: CLS
40 NEXT r

10 FOR r=0 TO 6143
20 POKE 16384+r,129
40 NEXT r

10 FOR r=0 TO 6143 STEP 256
20 POKE 16390+r,129
30 PAUSE 10
40 NEXT r
```



Special offer delayed

WE APOLOGISE to all customers who suffered delays in despatch of half-price ZX-81 software following our advertisements in the January and February issues of *Sinclair User*.

Due to phenomenal response, stocks were exhausted very quickly. We hope that all respondents have now had their goods delivered. Watch out for our next special offer.

The Software Workshop, Yew Tree, Selbourne, Hampshire GU34 3JP.

Past the post on Atic Atac

ON MONDAY, January 16 at 4.58pm, history was made. I, the first person ever to do so unless someone already has but is too lazy to write, finished Atic Atac. I have compiled a list of cryptic clues to aid all Attikers in their quest:

The key handle is the ULTIMATE piece; knights in shining armour win the day; the key to success is white; journey's end is near in the room with the impassable door; tread warily; beware of mobile trapdoors; barrels make useful staircases; a mapped-out adventure is easy to solve; to get Frankie, go for his bolt.

John Cockbill, aged 15, Evesham, Worcs.

Plot greater than graphics

IT SEEMS to me that more and more companies are putting all their effort into producing super, smooth, mind-boggling graphics at the expense of anything you could call a plot.

Companies must start designing new games which people will be still playing in a year's time. Only one company to my knowledge does so and that is Lothlorien with its war game series.

Steve Turner, Kidsgrove, Cheshire.

Covers with a touch of class

WHAT an original publication *Sinclair User* is. The cover photographs alone are proof of it. Some computer magazines feature scantily-clad dolly-birds in the hope of boosting sales. Other covers have endless and monotonous close-ups of computer keyboards but *Sinclair User* stands alone and has real class.

Uncrumpled *Sinclair User* covers could well be worth more than that prized stamp collection in a few years. Preserve your February issue with care. Whoever masterminded your devastatingly funny Wally of the Month series of cover photographs deserves a sales department medal. I cannot wait to buy the next issue.

Ian Russell, Llanbedr, Gwynedd.

More letters on page 26

Corridors lack the third dimension

I BOUGHT a copy of Corridors of Genon, acting on the review on page 52 of the December issue and on the Gilbert Factor of 9 awarded to it in Cassette Round-up.

I am astounded by your high regard for the program and that John Gilbert should consider it the equal of Halls of the Things. Where Halls is unquestionably challenging and addictive, Corridors is dull and aversive.

The claim that the program is 3D is rubbish. It uses a 2D projection with perspective. The term 3D should be reserved, as it is in the video world, for genuine stereoscopic 3D, be it by means of polarised glasses, lenticular grid, holography or whatever. To my knowledge, no program is yet 3D. To misuse the term 3D in this way can only bring confusion to the field of micro graphics and lower people's regard for it.

Peter Gardner, Ulverston, Cumbria.

● *The term 3D was not applied as a scientific definition but rather as a description of the graphical representation on a computer screen. Admittedly the term was used loosely but it was used to describe a type of graphics generally referred to by the computer games industry as 3D.*

In search of Logo tapes

I OWN a 48K Spectrum. I heard that the child-orientated Logo language is available for the Spectrum but, unfortunately, no computer shop which I visited here in Israel seems to be aware of it.

Could you please let me know if Logo is available in cassette form for the Spectrum and how could I purchase it?

Victor Harnik, Haifa, Israel.

● *A limited version of Logo is available from CP Software, 17 Orchard Lane, Prestwood, Bucks HP16 0NN. Sinclair Research will soon have Turtle Logo available for the 48K Spectrum which should conform to MIT standards. It will also use the Edinburgh Turtle.*

Singled-out for praise

I FEEL I must write to you in praise of two software houses. The first is Hilton Computer Services Ltd, whose Personal Banking System I have used for some time. Recently I have contacted the company on a number of occasions and each time I have received courteous and prompt attention.

The second company is Flowchart Ltd. Recently I purchased a copy of its Home Budget program. On running it I found it not entirely suitable for my needs. I wrote to Flowchart explaining the problem. By return I received an upgraded program and a spare data tape. Special service, indeed.

John Hadley, Oxford.

Preventative system crash

RECENTLY there has been printed frequently a method of stopping programs from auto-running on a ZX-81 using RAND USR 836 in fast mode. I am writing to tell you of a way of defeating this.

It works on the simple idea that when someone breaks into your program, the screen is displayed, and if you have pre-set system variable 16397, the system will crash:

```
9994 FAST
9995 LET X=PEEK
     16397
9996 POKE 16397, 0
9997 SAVE "........"
9998 POKE 16397, X
9999 RAND USR.......OR
     GOTO......
```

When someone tries to stop the program auto-running, it will make the computer display the screen before it reaches line 9998, so the system will crash.

Paul Taylor, aged 13, Whittlesey, Cambs.

Suitable graph paper found

IN REPLY to Michael Horgan's request for information — *Sinclair User*, January — on suitable graph paper for the Spectrum, I mention two products for less than £5 of which I know. Pixel-Pad is available from Computer Agencies Ltd, 28 Sun Street, Hitchin, Herts SG5 1AT and costs £4.99 for 50 sheets of A3 size paper.

ZX Spectrum Graphics Sheet is available from Keyboard Word Processing & Advanced Office Systems, 28 Forest View Road, London E17, and costs £4.25 for 50 sheets of A4 paper.

Refill pads for the Keyboard graph pad kits are available for £3.50 for a 50-sheet pad and can be obtained from Intelligence (G.B.) Ltd, 4 Oban House, Oban Street, Poplar, London E14 0JB.

P Dobson, Pitman Publishing Ltd, London WC2.

Perfect for beginners

THE BASIC problem of a displayed variable being different from the value of that variable held in the computer memory, as referred to on page 11 of issue No. 23, is easily overcome with the line LET N = VAL(STR$(N)). That changes the stored value, as follows:

```
10 LET N = 10**2
20 PRINT "N is ";N
30 PRINT "But 100 - N is
   ";100 - N
40 PRINT "N will now be changed
using VAL(STR$(N))."
50 LET N = VAL(STR$(N))
60 PRINT "N is still displayed as
   ";N
70 PRINT "But now 100 - N is
   ";100 - N
```

While writing I would like to defend the ZX-81 against some of the recently published comments of unreliability. I have installed eight ZX-81s at my school and they have worked perfectly for 18 months with daily use. The only difficulty has been the wearing out of the keyboards but replacements have been purchased and fitted easily.

I consider the ZX-81 an ideal beginners' computer and the latest 16K RAM pack designs seem to have overcome the infamous wobble problem.

We have linked all our ZX-81s to one tape recorder, so that one program may be loaded into them all simultaneously. That is a great advantage when using the computers as teaching aids.

All that is needed is a length of screened cable and sockets which are used instead of the EAR socket of the computer recorder. Note that the use of sockets avoids having to disturb the plugs into the ZX-81; tape recorder sockets seem much more resistant to repeated plugging and unplugging than those on the ZX-81.

Christopher Cox, Langport, Somerset.

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(J FARMER, EDINBURGH)

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CONFUSED by the vast choice of Spectrum programs? Don't be, we can help. We've played hundreds and chosen just the best of each sort. Details are in our catalogue - free with your first order. It's the only catalogue brave enough to put in the best, leave out all the rest and quote all the reviews! (We produce no programs ourselves - so our choice is impartial.) Of course, we have VALHALLA and THE HOBBIT (each £14.95) and MANIC MINER (£5.95), but here are just a few others that may surprise you (and will amaze you if you buy them!)

WE TRY TO SEND YOUR PROGRAMS BACK ON THE SAME DAY WE RECEIVE YOUR ORDER. Phone orders for VISA or ACCESS, 24 hours a day from any country where your own laws allow this! Mail order or phone credit card only. All games work with KEYBOARD CONTROL and joystix as shown.

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ANY SPECTRUM

DEATHCHASE *"Life in the fast lane ... Deathchase is essential ...some of the best 3D graphics I've seen." (PCGames)* Speed your Big Bike through the forest: you can only fire at top speed to kill the enemy bikers, tanks, helicopters. It's a night and day 3D chase that gets faster and faster. Amazingly realistic! KEMPSTON STIX. **(Micromega) £6.95**

THRUSTA HIGHLY ORIGINAL AND FASCINATING NEW ARCADE GAME from a new company! Very neat graphics as your beautiful spaceship (with 'real' gravity) pushes and drops rocks to crush the revolting wobbling monsters' eggs before they hatch. Watch out for the guards! Great big smooth graphics make you feel you are really there! Takes a long time to complete each screen. Well-chosen keys but also KEMPSTON STIX. **(Software Projects) £5.95**

PHEENIX *"This program has everything ... superb presentation, graphics and sound. Highly recommended." (HomeCompWeekly)* The full arcade-action 5 screens in the best-ever Spectrum 'Phoenix'. 5 skill levels. Choice of character sets: demo mode. Crams 48K quality into 16K. KEMPSTON/AGF STIX **(Megadodo) £5.50**

THE TRAIN GAME *"An excellent game ... original, well thought-out and full of action: absorbing and amusing." (S.User)* Run your own railway! Change the points to avoid crashes: watch out for hijacking by irate passengers. Full-screen graphics: 30 command keys: 2 track layouts. 7 skill levels: 14 sub-levels. Demo mode and Pause while you strike! Very catching hobby. NO STIX. **(Microsphere) £5.95**

3D SEIDDAB ATTACK *"One of the most impressive 3D progams I've seen." (PopCompWeekly)* Great 3D view through the turret of your tank as you patrol the city at night - glowing, luminous skyscrapers. Radar plan shows where you are - and were They are. 1 or 2 players and amazing flying saucers! You can see the damage they do to your tank as it happens! KEMPSTON STIX. **(Hewson) £5.95**

48K SPECTRUM ONLY

WHEELIE *"Lovely graphics, very, very difficult and challenging. Excellent value." (Crash)* Take off on your SuperDream Bike, jump buses and cars, watch out for hedgehogs as you search for the ghost rider. Will you find him? Will you beat him? Keyboard or ANY STIX. Some of the most spectacular graphics and sound we've met. Totally involving. **(Microsphere) £5.95**

PI-BALLED THE PIMANIAC'S Q-BERT!! Forget the horrible reggae flipside (you will eventually) and concentrate on changing the colour of the PYRAMID OF PI. Watch for the Piman and Sid the Snake, the Bouncing Balls, Col and Jas. 66 screens: transporter discs: graphic jokes. Buy it, it's wonderful! KEMPSTON STIX **(Automata) £6.00**

HUNTER-KILLER *"AN EXCELLENT SIMULATION." (PersCompNews)* Captain your own S-Class submarine: hunt down and kill the enemy sub: 18 controls (PROTEK STICK helps): dive, surface; chart your course: watch through your periscope the 3D target. Full-screen control room: chart room: periscope view. Quick-kill practice mode. Good full-screen graphics. Watch the track as your torpedoes run towards the enemy..... **(Protek) £7.95**

DENIS AMUSING and highly original text adventure. As Denis Thatcher, you travel up to 95 locations, seeking peace in the pub. You need to find a drink every few moves, while dropping in on the Royals, the MPs and, eventually, the Pope wearing a truss and carrying a lawnmower. It is all quite mad and lots of fun. 100% m/c. NO STIX. Written with THE QUILL (only £14.95!) The Thatcher adventure is by **(Applications) £5.50**

PAINTBOX *"If you've been looking for a Spectrum graphics aid, this is one of the best." (PopCompWkly)* We've tried it and, as they say, even a child can use it to define up to 84 User-Definable Graphics, draw all of them on-screen, save them to your programs: then there's the 2-speed hi-res drawing program and the 28-page manual and .... it is the most useful utility we've ever used. KEMPSTON/ANY CURSOR STIX. **(Print&Plotter) £7.70**

ALCHEMIST *"Graphically, this is probably the best game Imagine have produced." (PopCompWeekly)* Beautifully graphic arcade/adventure - as pretty as ATIC ATAC (£5.50) but entirely different. Amazing full-screen apparently endlessly different graphics as you search for the 4 parts of the Spell, turning yourself into a Golden Eagle from a Wizard (and back). Cast spell, fight the monsters with lightning bolts - and don't forget to eat too! Astounding. MOST STIX. **(Imagine) £5.50**

THE FOREST *"The world's most realistic adventure game." (PersCompNews)* RAVE REVIEWS all over for this fully graphic computer simulation of orienteering: you really feel you are map-making as you search for the Control Points. Draw 3D diagrams of the terrain, contour maps and feature maps. And there's 37kms of unmapped country for you to discover ...32-page manual helps. NO STIX. **(Phipps) £9.95**

STONKERS *"Excellent .... the best war game I've seen ... very addictive." (Crash)* The best battle-game graphics yet (NOT an arcade game). Simple joystick (MOST STIX) control: but the brain is in your strategy and tactics as you deploy and supply your troops. Beautiful large and small-scale maps of the battle area: moving graphics: great sound: tickertape messages: 2 skill levels. You are on the brink of battle ...make your first decision, NOW! **(Imagine) £5.50**

GO TO JAIL *"Excellent graphics are used to make a very impressive display indeed ... highly recommended." (ZXComp)* The best computer version of the famous game. From 2 to 5 players, including the Spectrum if you wish. It's ruthless, but honest. Every original feature is faithfully reproduced and the screen display (which scrolls helpfully) is simply incredible. NO STIX. **(Automata) £6.00**

HALLS OF THE THINGS *"The most exciting and innovative game I have seen ... no other game runs with such speed, smoothness of action and graphical quality." (ZX Comp)* Explore an 8-storey maze: find treasures: avoid nasties - but this time it's all graphic and you can see yourself waving your sword! Brilliant use of 19 command keys. NO STIX. **(Crystal) £7.50**

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		£
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	OUTSIDE EUROPE. Add £1 for each program airmail	£
	OUTSIDE EUROPE. ADD £1 TO TOTAL FOR REGISTERED MAIL. TOTAL	£

Improved floppy disc interface

A NEW floppy disc interface from Technology Research has now been upgraded further to allow you to LOAD and SAVE variables. By preceding the save name with a # all the variables will be saved. In addition, when SAVEing a program the variables are saved with it and when auto-run on LOADing it then does a GOTO 1 rather than RUN, which would have CLEARed the variables.

It is pleasant to see a company which is always trying to improve its products, especially as, in this case, it will cost no extra.

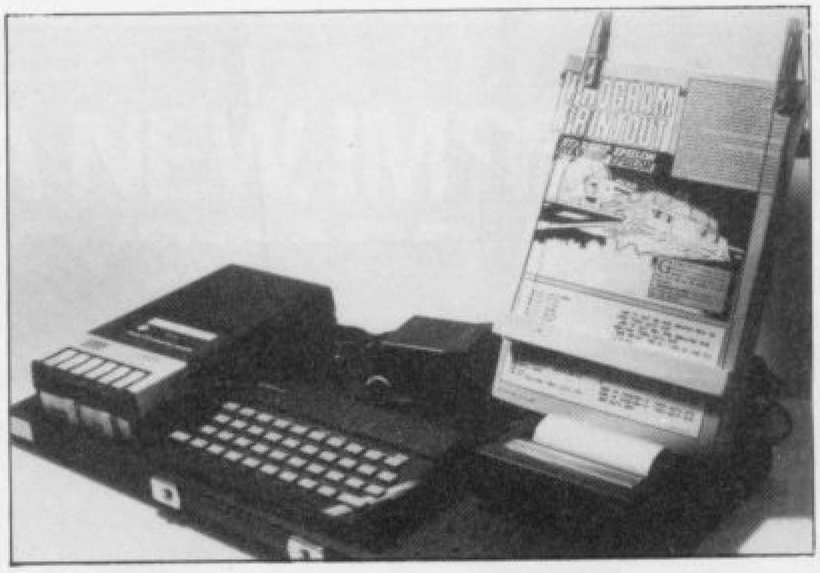
Details from Technology Research, 356 Westmount Road, London SE9 1NW.

Prototypes get finishing touch

KELAN, or rather its trade name Hobbyboard, is well-known among hobbyists as a supplier of hardware and complete kits. Its latest offering is a prototyping kit which can be used for the ZX81, Spectrum or Jupiter Ace. The kit — part No. HB/2090 — will give a professional finish to any project and can be used for many of the designs in *Sinclair Projects*.

In each kit are a prototype PCB, with space for 10 16-pin ICs — or perhaps 12 — and a Veroboard scratch pad, a Spectrum-style 28-way edge connector — that can be cut down for use on other machines — an extender card, a 9-pin D-type, Atari-style PCB mounting socket, and a case in which to put it all. Case screws are included.

Costing £9.50 inc., the kit is very good value. Contact Kelan (Hobbyboard), North Works, Hookstone Park, Harrogate, North Yorkshire HG2 7BU. Tel: 0423-883672.



In a category of its own

MOST COMPUTER hardware falls into one of two categories. Either it is a marvel of modern science or, as is unfortunately too often the case, it is over-priced and unnecessary. The Fatherboard, marketed by Censcot, could be said to be in a category of its own.

It could not be said to be visually impressive but it does what it was designed to do remarkably well. It is a board on which a computer and all its peripherals can be put securely so that they can be moved as a unit. It has an ingenious method of holding a listing so that it can be typed in comfort.

The main board measures 30cm. by 60.5cm. overall with rubber feet on the bottom and back edge. Into that is inlaid a piece of pegboard 27.5cm.×58cm. — with enlarged holes at strategic points. That is first removed. The computer, tape deck and any other items are laid out and then tied to the board using the wire supplied. There are also bolts to act as anchor points.

All the leads can then be threaded through the bigger holes and any slack hidden underneath. The pegboard is then replaced in the main board and screwed into place. Also supplied is a nylon dust cover which fits over the board with a hole at the front to allow access to the carrying handle on the main board. As everything is secured to the board it can be carried and stored vertically.

The copyholder is a board which is secured vertically to any two holes on the pegboard. On to that the moving cursor is fitted. That is two clothes pegs through which a piece of string has been threaded. Tied to the string are two pieces of wood. When properly arranged, one piece of wood can be moved up and down to keep track of where you are in your listing.

If you have sat on the edge of an armchair in front of the family TV with a computer on one knee and a magazine on the other trying to type in a listing surrounded by wires and pieces of computer, only to be told to clear everything away, then you can see how useful the Fatherboard could be. It may not be much to look at but it is well-thought-out.

Fatherboard is marketed by Censcot, 25 Laurelhill Place, Stirling, Scotland FK8 2JJ. It costs £17.50 plus £1.50 p&p.

Competitive joystick

REGULAR READERS of Hardware World may remember the mechanical joystick reviewed in the February issue. New from EEC Ltd is another joystick which clips over the Spectrum case and presses the 5, 6, 7 and 8 cursor keys mechanically in response to the movement of the stick.

The casing is a one-piece moulding which fits very snugly to the Spectrum case. Inside that the stick is joined securely to a shaped plate which then presses down on one or more levers to depress the key. The design appears to be well-thought-out, with attention paid to its strength.

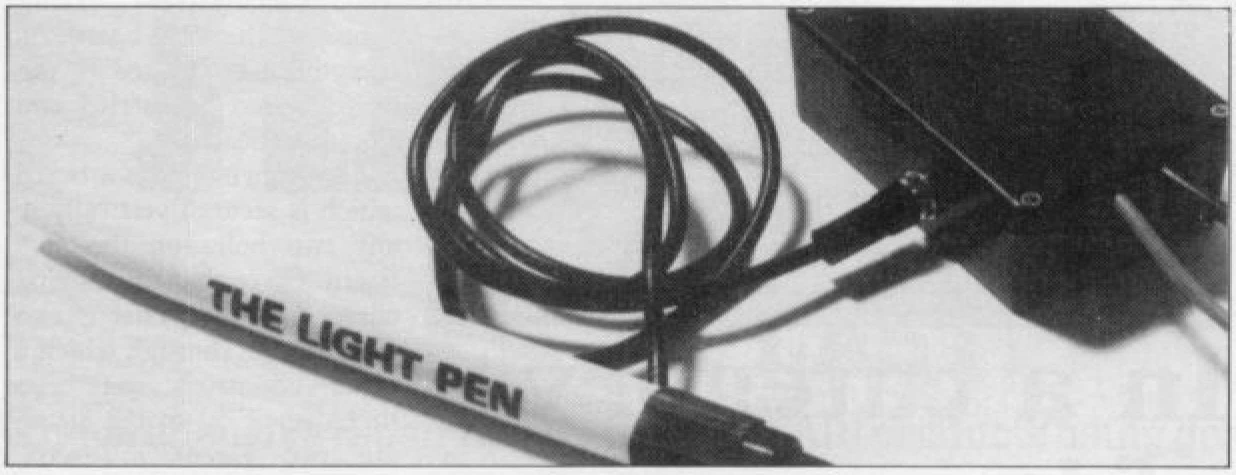


A previous criticism of this type of joystick was that it would work only with games configured to use the cursor keys and that is still so but EEC includes details of more than 60 games which can be played with the joystick.

Retailing at £9.95, or from EEC with an extra 55 pence postage, the joystick is competitively priced. EEC is at 1 Whitehouse Close, Chalfont St Peter, Bucks SL9 0DA.

More hardware on page 30

Light pen makes menu choice difficult



AMONG Add-On Electronics hardware is a light pen for the Spectrum, a device which, when pointed at the TV screen, can indicate to the computer where the pen is pointing. Included in the software provided with the pen are 16 routines to allow you to draw pictures using the facility.

The light pen is in two parts, the pen and, second, a small box containing the electronics into which it is plugged. The Spectrum power supply is then plugged into the side of the box and another lead is plugged into the Spectrum power socket. Once the software tape has been loaded the other lead from the box is plugged into the Spectrum EAR socket and you can use the pen to run the program.

A television set works by moving an electron gun across the screen and where the electrons fall the phosphor on the screen will glow. To make up a picture the gun starts pointing at the top left of the screen and then moves down in a zig-zag fashion making, on a modern TV, 625 sweeps across the screen. It does that 25 times per second. If you know when the gun starts scanning the screen you can time how long it takes to reach any given point.

Inside the light pen is a BPW148 photo-transistor with one leg cut off. When light falls on it a current passes through it. The software enables the computer to measure the time between the electron gun starting a new scan and the light pen passing a current. The time interval shows at what point on the screen the pen is being pointed.

Obviously the timing is critical and here the software fails to do its job. It was almost impossible to use the program provided as, when picking from the menu, the pen would be pointed at the chosen square, but the software assumed it was being pointed up to 2in. to the left, choosing another menu selection.

If it had been consistent, that problem could have been overcome but the error varied according to the area of screen selected and by a random element. The instructions provided with the pen give a short Basic program to allow you to adjust your set to the pen. That did not solve the problem. The error may be due to the television set used and may not occur on all sets. If possible, borrow a pen from a friend and try it before buying.

It is interesting to note that the instructions mention there being a fine control on the light pen box when there is none, either externally or internally, on the printed circuit board.

The only other light pen with that control is one made by DKTronics, which shares the same address as Add-On Electronics. To confuse the issue further the software cassette with the pen bears a copyright notice from a now defunct company, Kayde, and the picture on the light pen box is the same as that used in Kayde advertising.

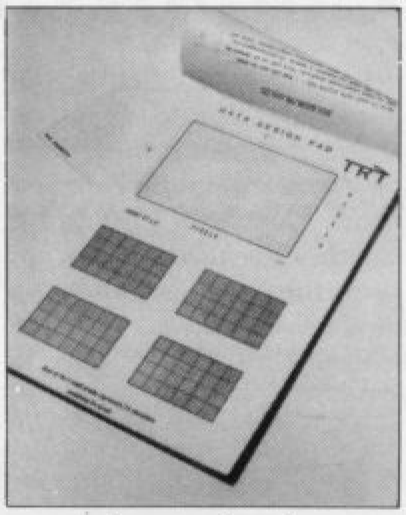
Both the other light pens sold for £10 less than the Add-On Electronics version.

At £30 the pen can be obtained from Add-On Electronics, Units 2, 3 & 4, Shire Hill Industrial Estate, Saffron Walden, Essex CB11 3AQ.

Having designs on graph paper

WHEN CREATING designs on Sinclair machines, a piece of graph paper is invaluable but its only disadvantage is that most commercial paper has a 10 × 10 grid. The Data Design Pad solves the problem by providing two different grids. The first has 22 squares by 32 and is ideal for designing a screen layout using individual characters. The second has 24 squares in a 6 × 4 pattern, each square being further divided into an 8 × 8 grid, and can be used for individual user-defined graphics or larger designs. Every pad has 50 sheets, each sheet having one of the former and four of the latter grids.

At £4.60 for one, £7.70 for two and £10.70 for three pads, all inc., they are by no

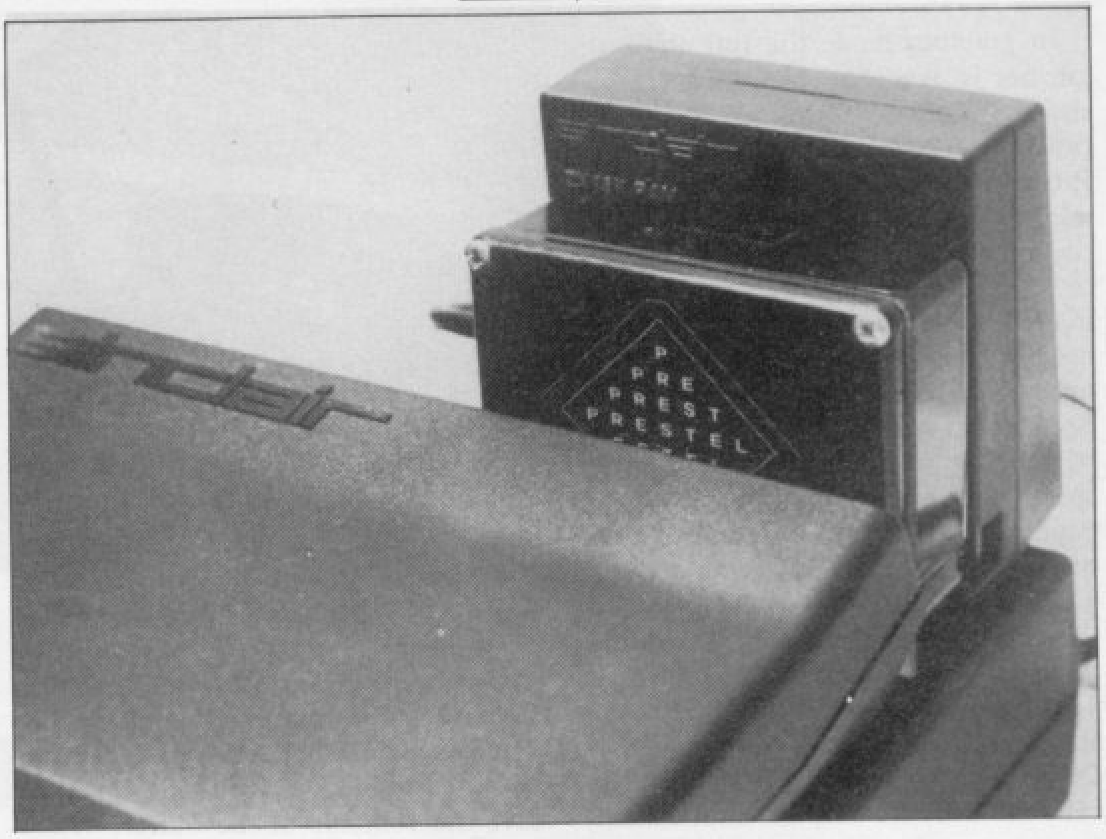


means inexpensive, but can save a good deal of time. They are available from TRT Designs, 43B Nightingale Lane, Clapham, London SW12 8SU.

Spectrum under cover

NEW from PDQ Software is the Galaxy dust cover for the Spectrum. Made in a metallic blue PVC with a silver flash, the cover provides an attractive means of keeping a computer clean. There is even a cut-out on the back of the cover to enable you to leave all the leads and any add-ons plugged-in.

Priced at £1.75 inc., the dust cover is available by mail order from PDQ Software, Parsley Rye, Hilders Lane, Edenbridge, Kent TN8 6JU.



Communications with the ZX-81

John Lambert investigates a new idea

IT IS UNUSUAL in the Sinclair hardware world to be presented with a completely new idea. The Universal Modem Adaptor from Microcomputer Resources Ltd is such a device. With the adaptor your ZX-81 can now communicate with almost any other computer and, with the addition of a suitable modem, it can "talk" to most of the large Information Providers such as Prestel, Micronet, Rewtel, Cashtel and many more.

It would be best to explain some of the terms. First, a modem, standing for MOdulator/DEModulator. It takes electronic signals from a computer and translates them into a form which can be sent along a telephone line; it also takes signals from the telephone and translates them back into a form the computer can understand.

An Information Provider, in this sense, is a computer database which can be accessed via a telephone line. To be able to do that the adaptor has to use a means of communication which the IPs will understand, first in the way the information is coded for transmission and, second, what each code means. For transmitting and receiving it uses a standard known as RS232, a method where some bits of each byte are set, or not, to indicate where each byte starts and stops and also the content of the byte. Readers may care to look at a longer explanation of this in the January issue of *Sinclair User*.

There is a version of this standard for use on telephone lines laid down by British Telecom called the CCITT. The standard way of interpreting the code is similar to ASCII and has two forms — that laid down by Prestel, which includes an alphamosaic graphic set, and that known as CET from the Council of Educational Technology, which devised a system whereby telesoftware could be downloaded to a microcomputer.

> 'If you then want to access Prestel, all you have to do is to connect the modem to a socket and plug a telephone in the back'

The adaptor plugs into the user port of the ZX-81 and needs a 16K RAM pack plugged in the back. If you have a Sinclair printer you can also use it to COPY frames. A lead from the side of the adaptor terminates in a 5-pin DIN plug. The lead carries the Transmit data (TXD) and Received data (RXD) lines, plus earth (COM). For the purpose of the review of Prism Modem 1000 which has a 5-pin socket into which the lead plugs was used.

Inside the adaptor is a 4K EPROM which resides in memory from 8K to 12K and is called into use by the command RAND USR 8192. At that you are presented with a greetings page which fills the screen, as suddenly you have 40 columns rather than the usual 32. If the sides of the message are off the screen, by using the left and right cursor keys the whole screen can be made to scroll in that direction.

If you then want to access Prestel, all you have to do is to connect the modem to a telephone socket and plug a telephone in the back. With the switch on the front of the modem set to M/NET, you dial Prestel and when you hear a continuous tone you put down the line switch and are presented with the Prestel greetings page and a request for your password. To access other IPs the system is similar but will depend on how quickly they can send and receive their data.

Prestel presents the ZX-81 with a problem, in that it is a colour IP and, of course, the ZX-81 can work only in black and white. The adaptor circumvents the problem in two ways; by using a system of colour weighting it notes the relative intensities of the colours it should be using and then prints in either black on white or white on black — that method can be turned off if necessary. It is also possible to invert the screen, to print white on black as normal.

Another problem with any data sent by telephone is that any noise on the line can be interpreted as data. If that happens, by use of the shifted 7 key a message is sent back to Prestel (*00) and the whole page is re-transmitted.

Only the number keys are used normally, plus new-line — which has been reconfigured as - and the fullstop — reconfigured as *. If, however, you want to send a message, telegram or use the Mailbox facility, the rest of the keyboard can be used, the alphabetic keys giving lower-case and upper-case when SHIFTed.

continued on page 34

ZX-81 Modem Adaptor

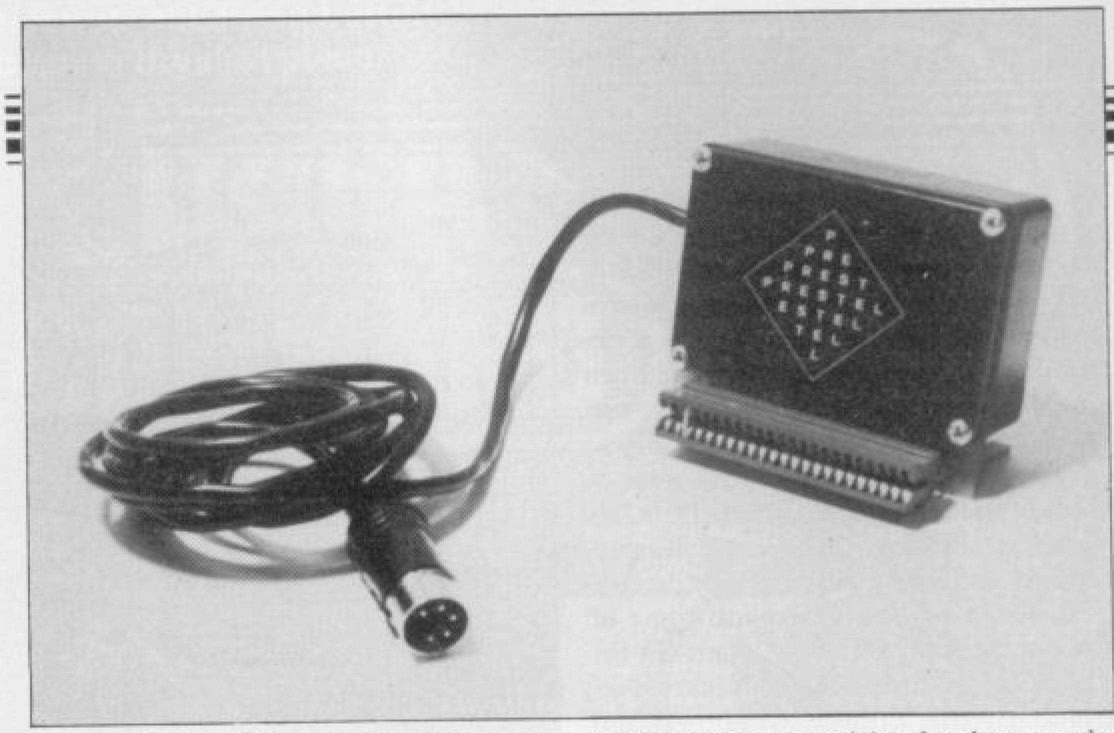
continued from page 33

In graphics mode the full alphamosaic set is available, including double-size characters. Also available in function mode are all the necessary Prestel control codes. The only ones missing are cursor on/off, flash and conceal/reveal.

While the adaptor was designed initially to be used with Prestel, it can be used to access other databases. On start-up it sets a number of variables to the Prestel standard, which can be changed by the user. The first of them is the speed of data reception/transmission or baud rate — bits per second. Prestel uses 1,200/75 while other IPs may use 1,200/1,200 or 300/300 and you have the choice of all three. The Prism modem can work only at 1,200/75 or 1,200/1,200. Second, while RS232 is a standard, it has many versions and is, in fact, not very standard. For the technically-minded, the adaptor is set initially to one start bit, seven data bits, one even parity bit and one stop bit. You can then toggle — set or not — odd/even parity and also between enabling parity of not, with don't care on input and a stop bit on output.

Finally, some IPs — not Prestel — require the screen to scroll up and that can also be toggled on and off. Screen scrolling is rather slow at about one-third of a second but should not present a problem.

There are even more features built into the adaptor. If you want to send a message, obviously to sit and type it out while connected to a telephone line could be both expensive and time-consuming. To that end there is a 5K area of memory set aside as a Local Message Buffer where you can store up to five pages or frames. You can therefore compose your message at leisure and send it all at once.



The buffer can also be used to download individual pages for later use. In addition, Microsource has built-in a fast cassette interface which will load or save the contents of the buffer. When saving it puts out a three-second tone to set the level on recorders with an automatic level control and then saves at more than 250 characters per second.

The adaptor has the codes for the CET standard built-in. With an IP such as Micronet which has software to be downloaded — at the time of writing that facility had been inhibited — by finding the header frame and then calling the downloader routine programs up to 12K can be downloaded. The adaptor checks each page as it is loaded, trying again automatically if it finds an error and, when complete, sends a log-off message (*90). It then checks the program for syntax errors and puts a REM statement with a question mark at the start of the line if it finds one.

If you want to connect your modem to the adaptor, provision has been made for a wide variety of inputs. Although it operates at TTL levels — 3.5V — 0.2V — the input pin is connected to a resistive diode network so that it can accept the full +/−12V. It also has inverter gates which can be by-passed should your modem require it. On output, the adaptor generates tones to conform to CCITT V23.

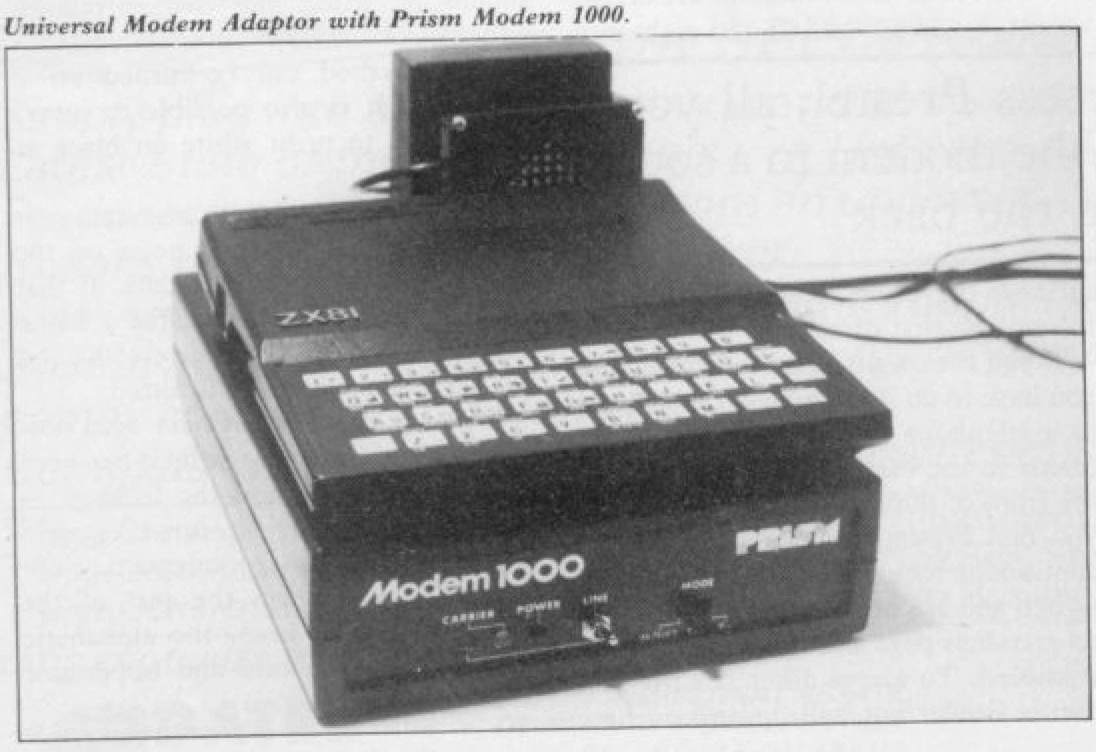
For the technically-minded, the adaptor contains a ROM, two single-bit ports and an eight-bit buffer. The buffer is used to provide the bit graphics. When the ROM is called the Basic ROM is paged-out and the adaptor runs five interacting tasks. It samples the input port, converting its contents to ASCII and storing it in the display buffer. The screen buffer is then sent to the TV and the keyboard is sampled.

Finally, the display buffer is interpreted to generate the screen buffer. When either sending a character or COPYing the screen to the printer, all other tasks are suspended. About 10K of RAM is used for the bit-mapped display and workspace, 5K for the local message buffer and 1K for Basic, which is used when downloading a program. If the program is more than 5K long, space is taken from the display, which is then turned off.

All in all, it is an extremely well-designed piece of hardware with a multitude of uses. On its own it can be used to generate teletext graphics which provide greater flexibility than the standard ZX-81 set; with a modem it opens a world of information literally at your fingertips. The thought which has gone into it is obvious and at £29.95 it represents very good value. To obtain similar features on another computer you would have to spend at least twice as much, if not more.

For further information contact Microcomputer Resources Ltd, 1 Branch Road, Park Street Village, St Albans, Herts. Tel: 0727 72917.

Universal Modem Adaptor with Prism Modem 1000.





EXCLUSIVE OFFER

Sinclair User has negotiated an exclusive offer with Microcomputer Resources for the ZX-81 Universal Modem Adaptor and the Prism Modem 1000. Together they enable the 16K ZX-81 user to access the outside world.

The **ZX-81 Universal Modem Adaptor** is a low-cost entry into the field of data communications. It provides all major Prestel features: 24 lines of 40 columns, upper- and lower-case characters, viewdata graphics, alphanumeric talkback and the ability to download programs according to CeT standards. The adaptor has a choice of baud rates to cover the normal standards, parity control options and scrolling, as well as an off-line editing mode with block sending capability, a fast cassette interface and a ZX printer screen dump.

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Normally priced at £30, we are offering the ZX-81 Modem Adaptor for only £22.50 including VAT and postage and packing.

The **Prism Modem 1000** not only allows access to viewdata services, but also enables the user to communicate directly with other modem users, via the telephone line. It incorporates a self-test facility to check that both the modem and the computer are functioning correctly. The modem usually costs £69.95. *Sinclair User* readers can obtain it for only £63 including VAT postage and packing.

Both items can be ordered separately or together. Simply fill in the order form below.

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Send to: **Microcomputer Resources Ltd, 1 Branch Road, Park Street, St Albans, Herts AL1 4JR.**

Please supply the following:

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	Prism Modem 1000	£63.00	
		Total due	

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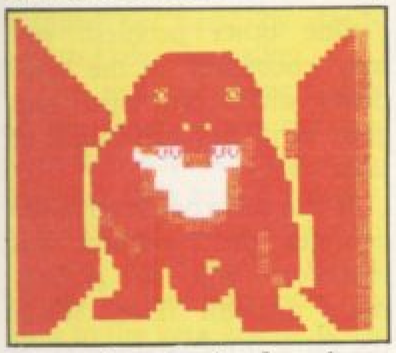
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Golden Oldies

For the benefit of new ZX-81 owners we look retrospectively at some chart-toppers of the past

IT IS unfortunate but true that the ZX-81 seems to have slipped from the minds of software authors who look at it with embarrassment and wish it would go away. If anyone were to suggest that more software should be written for the black-and-white, low-resolution machine the instigators would be regarded as mad and informed quietly that the ZX-81 is no longer commercially viable.

That is to forget, however, that there are still thousands of users who want to be satisfied in terms of software and that their ranks are increasing every day. It is for those people who still hold the ZX-81 in esteem that we look back at products which are still on the market and about which new owners may not know.



The most prolific software house for the ZX-81 which is still manufacturing for the market is New Generation. It has great pride in its products because it produced the first 3D game, **3D Monster Maze.**

The game puts you into a three-dimensional maze, using conventional ZX-81 graphics speeded with machine code. The effect is incredible and the program could be for a black-and-white Spectrum. It gives the effect of high-resolution graphics.

You are not alone in the maze, as you will find when you discover the footsteps which are plodding slowly towards you. If you are lucky you will lose the owner of those big feet, or he will lose you. If you are not so fortunate you will see Tyrannosaurus Rex moving towards you along the corridor. At that point it might be a good idea to run or you will be eaten.

Contrary to popular belief there is a way out of the labyrinth and when you find it you will be shown a pretty graphics display along with a 'you got out of this one' message. The game can be made more difficult but the initial playing level is sufficient for beginners.

The only criticism of 3D Monster Maze is the long wait, in FAST mode, while the maze is set up. That is a time of seemingly unending boredom but it is soon forgotten when play begins. 3D Monster Maze is essential for all owners of the 16K ZX-81.

Another famous name in the ZX-81 market is Orwin Software. Michael Orwin, the compiler of a number of games tapes, appears to take a less active role in the company now but his ZX-81 software is still selling well.

There are five cassettes in all but only the first takes the 1K ZX-81 into account. It includes 11 programs, seven of which are in machine code. The good thing about the software is that the same games are recorded on both sides but not in the same order. That means you can always reach a particular program quickly, so long as both sides will load.

The games include several old arcade favourites, such as **Invaders, Planet Lander** and **Maze of Death.** They are all fast in action although, even with the ZX-81 keyboard, they are easy to play.

The other programs on the cassette are also very inventive and include **I Ching,** a Chinese prediction program, **Codebreak,** which is self-explanatory, and an unusual program, **Bouncing Letters.** Cassette One costs £3.80 and is worth every penny.

The rest of the ZX-81 cassettes from Orwin are for the 16K machine. One of the best is Cassette Four which contains eight games. All of them should be familiar as either arcade or traditional games but each is well-thought-out and the graphics are good for a ZX-81.

Gunfight is the best game on Cassette Four so far as graphics are concerned. It pits you against a gunfighter you must kill in a shoot-out. The other obstacles in the duel to the death are two cacti and a wagon which moves continually up and down the screen. The computer is fast on the draw and you will need precision timing to survive.

ZX Scramble is another good arcade game in the package. It includes three stages in which you have to fight your way through the passages of alien subterranean caverns.

You gain points for destroying the aliens which fly at you and also for bombing the aliens which are on the floor of the cavern. You must, however, beware of the ceiling which will dip to meet you as you travel from left to right on the screen. Because of the speed at which your spacecraft travels you are likely to be destroyed more by low-flying ceilings than by aliens.

Other games on the cassette include a 3D version of **Noughts and Crosses,** two invader-type programs, a version of **Conway's Game of Life** and **Snakebite,** in which you have to avoid a poisonous reptile which wants to cut short your life. Cassette Four again provides value for money and costs £6.

Another company which was to the fore of the ZX-81 software boom was Quicksilva. It produced a remarkably good version of Defender which is still around, called **Defenda.** Unlike space invader games, your craft moves across a landscape from left to right on the screen, destroying all in its path or being destroyed by the aliens which drop bombs or crash kamikaze-style into your battleship.

Adjustments can be made to the program if your television set cannot keep pace with such a fast game and you will usually have to make some kind of adjustment to get rid of a screen display which might bend or flash.

The game is fast, furious and almost impossible to play. It should cater for all arcade addicts who still hanker for new versions of original arcade games. Defenda from Quicksilva costs £3.95.

3D MONSTER MAZE
Memory: **16K**
Price: **£4.95**
Gilbert Factor: **9**

CASSETTE ONE
Memory: **1K**
Price: **£3.80**
Gilbert Factor: **7**

CASSETTE FOUR
Memory: **16K**
Price: **£6**
Gilbert Factor: **7**

DEFENDA
Memory: **16K**
Price: **£3.95**
Gilbert Factor: **8**



Old favourite is right on target

THE GUARDIAN, for the 48K Spectrum, is the first version of the classic arcade game Tempest for the machine. You are in a spaceship on the edge of a vortex into another universe. Through the doorway flit groups of aliens intent on destroying you. Each has its own attack patterns which you must study closely if you are to survive.

To destroy the aliens you must use your laser bolt gun. You will also have the opportunity to use two secret star smasher weapons which will fizz down the sides of the vortex and destroy everything trying to exit.

The Guardian, from PSS, is a spirited attempt at producing a version of Tempest, a game from which everyone else has shied away. It is a difficult game to run at a reasonable speed and, although the author has simplified the game, it is still worth playing.

It is not often that we would recommend a take-off of a game found in arcades as the market is becoming more sophisticated and demands greater originality. The Guardian provides nothing spectacular in innovation but it is easy and fun to play.

THE GUARDIAN
Memory: **48K**
Price: **£5.95**
Joystick: **Kempston**
Gilbert Factor: **6**

Horses take over in heavenly joust

BELIEVE it or not, you have been put in a saddle in the sky in **Winged Warlord** for the 16K Spectrum. The horse you are riding has wings and you have a lance with which you must unseat the blue warriors from their winged horses.

Unseating the blue devils is not sufficient to kill them as they float to the ground, as if they had parachutes. You must run them through with your lance before their faithful steeds come to the rescue.

The game is similar to arcade Joust which has stormed the States and is finding favour in Britain. The ostriches used in the original version have, however, been replaced by horses.

There are two ways in which you can die during the game, when you will lose one of your four lives. You can be unseated by an enemy knight or you might encounter the Evil Bird of War which looks more like a duck than a personification of evil.

The graphics are amusing and the game is fun to watch as well as play.

Winged Warlord has a two-player option. That means only that you can take turns to spike the enemy and notch high scores. It is a pity



players cannot challenge each other using different parts of the keyboard. The game would have been slower on that option but more interesting. It can be obtained from CDS Micro Systems.

WINGED WARLORD
Memory: **16K**
Price: **£5.95**
Gilbert Factor: **6**

Graphics redeem maze game

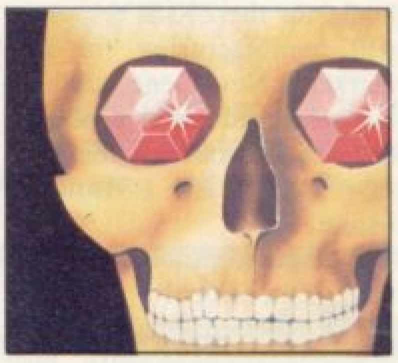
YET ANOTHER three-dimensional maze. It is incredible that anyone with a sense of what the market expects should produce another maze game in which you move round collecting treasure and gaining points.

The damning criticism may be just a little too harsh — but only just. In **Skull,** for the 48K Spectrum, you also have to avoid the skulls with jewelled eyes which inhabit the complex and make sure that you do not get stuck in corners of the maze where bars fall from the ceiling.

One other problem you may encounter is the trapdoors which will open and close as if they had minds of their own.

If you solve one level of the complex the computer will transport you to another more difficult floor. When the game finishes you may be able to put your name on the high score table which takes your level number into account.

The graphics and the quick and easy response of the game are two factors in its



favour. It is, however, difficult to find the instructions when playing. Skull is produced by Games Machine.

SKULL
Memory: **48K**
Price: **£6.95**
Gilbert Factor: **5**

Apeing the antics of Donkey Kong

MONKEY BIZNES is not a new version of the famous Marx Brothers film but a game for the 48K Spectrum. The monkey in the game is King Kong and, if you had not guessed already, it is another version of the classic arcade game Donkey Kong.

You have to rush up the scaffolding to rescue the fair maiden in distress. To do so you have to hammer the barrels which are thrown at you by Kong or dodge them if you do not have a convenient hammer to hand. If you fall from the scaffolding and you have one of your umbrellas handy you can float down a level and try again.

If you manage to reach the top of the scaffolding on one level a ladder will extend heavenwards and you will climb up to the next level. You will continue to risk your life climbing until all your four lives have been lost.

Monkey Biznes, from Artic Computing, is an amusing and colourful game. It would have been much better if released several months ago, as there are several similar games on the market. It can also be a bit tedious after you have been through several levels of play.

MONKEY BIZNES
Memory: **48K**
Price: **£5.95**
Gilbert Factor: **7**



May the force be with you

ADD-ON ELECTRONICS **3D Star Wars** might even win a prize as the worst piece of software on the market. The least of the criticisms cover the instructions which are far too long and, perhaps for copyright reasons, give a different plot on the cassette insert and the game. For instance, on the cassette insert the hero is called Luke Clearthinker but in the game the hero has obviously changed his name by deed-poll to Luke Skywalker.

The real criticisms focus on the game. There are too many keys with which to control your ship and, if you try to remember where each one is, you could easily forget which button you have to press to fire your lasers. With a little experimentation we managed to find the key just before we were eventually destroyed with a score of zero.

The graphics are lifeless and produce one of the poorest versions of 3D we have seen. Because of the mess of graphics darting in all directions on the screen, which are supposed to be rebel ships, it is difficult to tell in which direction you are moving even if you have your finger on a particular movement key.

The screen looks more like a patchwork of coloured blobs than a spacescape. If you buy the game, may the force be with you. You will need it.

3D STAR WARS
Memory: **48K**
Price: **£5**
Gilbert Factor: **1**

Snowman all set to melt the ice

THE SNOWMAN, for the 48K Spectrum, is a game based on the best-selling book of the same name by Raymond Briggs. It is based loosely on some of the action in the book but it centres on the building of the snowman. It should appeal to young children because of its non-violent nature.

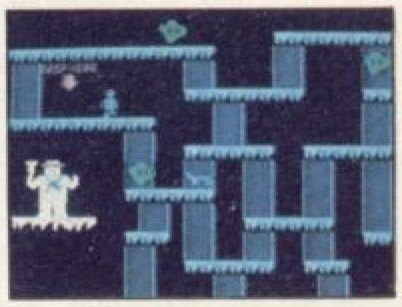
To build the snowman you have to collect snow and avoid the flames which will chase you so that you can turn it back into water.

In some ways the game is like Jet-Pac, from Ultimate, as there is a drop site on the left of the screen which you must reach to mould the snowman's body and dress him.

There are four stages to each round. The first is to collect the snow, the second to put on the features, the third to dress the snowman and the fourth to collect ice cubes to prevent him melting. Once all of those phases have been completed you will move to round two and a different screen layout.

There are two ways of winning points. You could forget about building the snowman at the first stage and collect objects such as crackers, stockings and Christmas trees. That will boost your score considerably, so long as you do not fall from the ice structure. If you do, or your energy level is depleted too much, you will fall back into bed.

The alternative is to build the snowman but risk the wrath of the sleep monsters,



which can only be combatted using the special alarm clocks.

The game is attractive and is a change from the violence of Space Invaders and the like.

The Snowman, from Quicksilva, combines the best of many games already on the market.

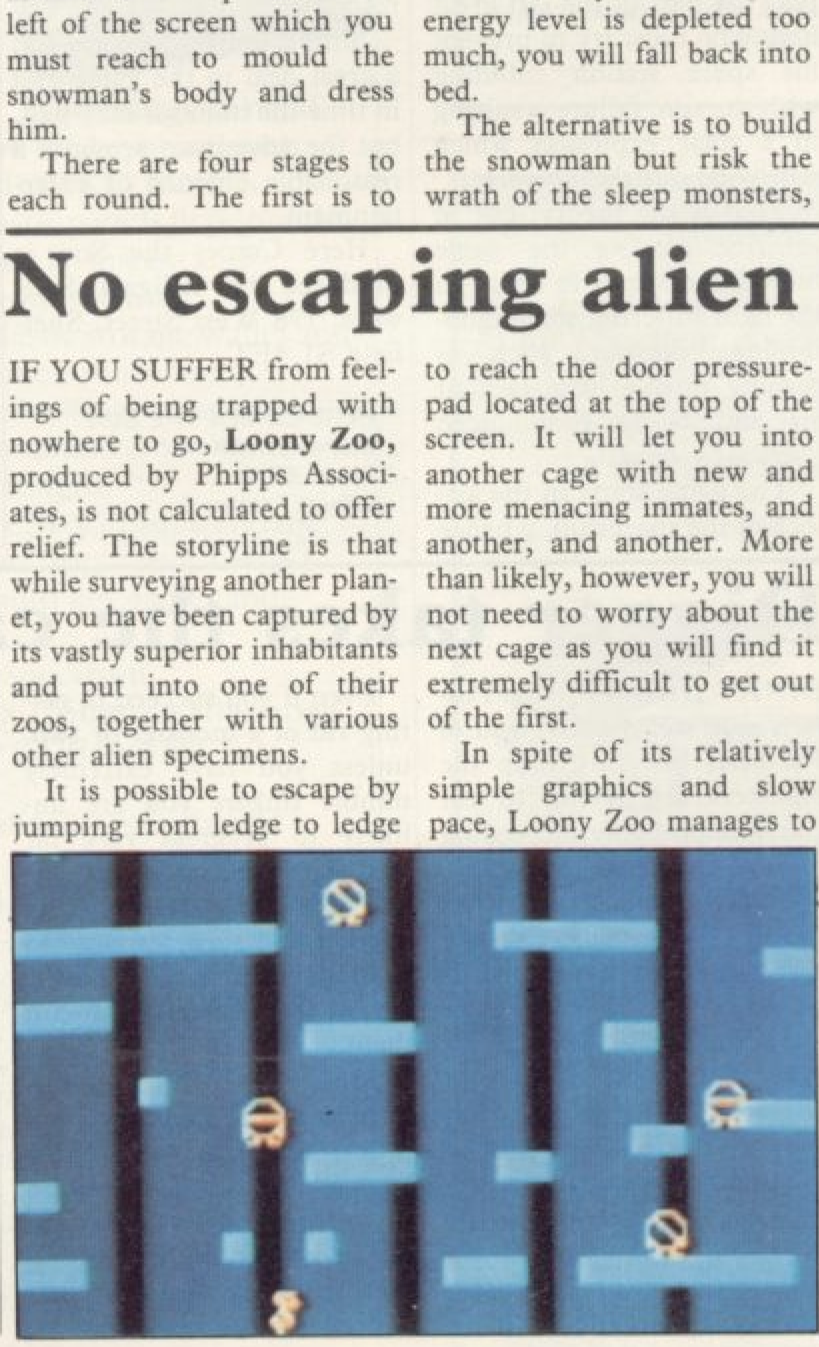
SNOWMAN
Memory: **48K**
Price: **£6.95**
Joystick: **Kempston, Cursor**
Gilbert Factor: **8**

No escaping alien trap

IF YOU SUFFER from feelings of being trapped with nowhere to go, **Loony Zoo,** produced by Phipps Associates, is not calculated to offer relief. The storyline is that while surveying another planet, you have been captured by its vastly superior inhabitants and put into one of their zoos, together with various other alien specimens.

It is possible to escape by jumping from ledge to ledge to reach the door pressure-pad located at the top of the screen. It will let you into another cage with new and more menacing inmates, and another, and another. More than likely, however, you will not need to worry about the next cage as you will find it extremely difficult to get out of the first.

In spite of its relatively simple graphics and slow pace, Loony Zoo manages to be infuriatingly addictive, especially if you enjoy a challenge to your reflexes.



In a similar vein from Phipps Associates is **Killer Knight,** in which, because of a freak time-slip, an evil knight has dragged away your girl friend whom you must try to rescue. The medieval trappings cannot disguise the basic Kong pattern.

The hero's flea-like hopping movements are novel but otherwise the difficulty of getting very far into the game without starting again, and the fact that it is possible to notch a high score by running back and forth along the bottom level, make it slightly inferior to some variations on theme.

LOONY ZOO, KILLER KNIGHT
Memory: **48K**
Price: **£5.95**
Gilbert Factor: **6, 5**

More Software on page 40

A bridge for the novice player

BRIDGEMASTER, for the 48K Spectrum, is nothing to do with the programs which claim to play full versions. It fulfils the worthier aim of teaching the player how to play Bridge.

The course is split into a series of lessons using the Acol system, based on hands dealt by the computer. It starts simply by giving the user a chance to see play in action and you can follow play on the screen with an audio cassette which provides background narrative.

When the narrative is finished you have a chance to play the hands discussed in the lesson and the computer will inform you of any mistakes you make. There are 55 deals which you have to run though in that way, although the package makes each interesting in turn.

Also included with the four tapes, two for software and two for commentary, is a short instruction book which is helpful in setting up the course and letting the user know about the standards used, and a book by expert Terence Reese. The book is not related to the software but it shows that an expert has faith in the package.

As well as providing an easy introduction to the subject, **Bridgemaster** will make people who would not normally be interested in the subject into addicts. It is a product which will make you feel you want to gather some friends and get out the cards. It is a welcome change from programs which would have you play Bridge with them.

Bridgemaster can be obtained from the usual computer outlets, including W H Smith and Boots.

BRIDGEMASTER
Memory: **16K**
Price: **£24.95**
Gilbert Factor: **9**

Ghost rider rules in duel of death

FIND the ghost rider and race to death in **Wheelie,** a motor-cycle game for the 48K Spectrum. Before you can take part in this death race you will have to hunt through the many strange roads in the cavern scenario for the mysterious figure on a motor-cycle who will be your opponent.

In the caverns you will find hazards such as buses and cars to jump over, ice and gas to avoid, and ramps to pass over to reach the various parts of the cave system.

Your machine has all the latest equipment and will accelerate to phenomenal speeds. You should be careful, however, as many of the roads in the ghost rider's world are dead ends.

When you crash your rider will fly from his machine and skid to a halt on the road. While the animation is excel-



lent, during those effects the crash sequence is a little too graphic and some people might find it tasteless.

Wheelie can be obtained from Microsphere Computer Services Ltd, 72 Roseby Road, London N10 2LA.

WHEELIE
Memory: **48K**
Price: **£5.95**
Joystick: **Most joysticks — key program option**
Gilbert Factor: **7**

Sun burn can be terminal

IF YOU do not take adventure games too seriously, you might enjoy **Here Comes the Sun** from Alligata Software. In this somewhat tongue-in-cheek tale, you play the part of the last great hero who must try to prevent his space station colliding with the sun, failure resulting in a solar explosion which will wipe out the universe.

That is the theory, but in practice playing the game more often seems to result in the hero suffering some ignominious disaster, such as turning purple from lack of air and being pronounced "seriously dead".

The game starts in the air-lock of the spaceship, whence you must trace your way to the retro-rockets which will enable you to pilot the ship to safety. Unfortunately, giving perfectly sensible commands does not often elicit a sensible response.

Simple graphics do not add a great deal to the game and in time the humour may pall, but the adventure provides a reasonable amount of entertainment.

Here Comes the Sun is produced by Alligata Software, 178 West Street, Sheffield S1 4ET.

HERE COMES THE SUN
Memory: **48K**
Price: **£5.95**
Gilbert Factor: **6**

Digger takes the cake

DINKY DIGGER from Postern may well remind you of Pac-Man but this time the monsters are trying to eat you, and probably succeeding most of the time.

The object is to clear the screen of cherries, eventually grabbing the cake to be found at the centre. The Pac-man-like monsters meanwhile are doing their best to prevent you achieving your aim, but it is possible to eliminate the monsters by throwing a crystal ball at them, or by running under an apple in the hope that it will fall and flatten them.

Even if you succeed in getting rid of a monster or two, unless you have extremely nimble fingers you are unlikely to progress very far into the game. One monster is followed quickly by another and slow response to the movement keys makes it almost impossible to out-run them.

Most people will find they have lost a life in no time and it is a pity that the authors have added to the frustration of the game by making the player wait for an infuriating little tune to finish before embarking on another attempt. When the game is finished, a score table is displayed which features an action sequence of the hero throwing a ball at one of the monsters and, appealing though that may be the first time, it serves only to slow the action when it is repeated.

Dinky Digger is definitely not for the novice, although it might appeal to experienced players eager to improve their keyboard skills.

DINKY DIGGER
Memory: **48K**
Price: **£6.95**
Gilbert Factor: **4**

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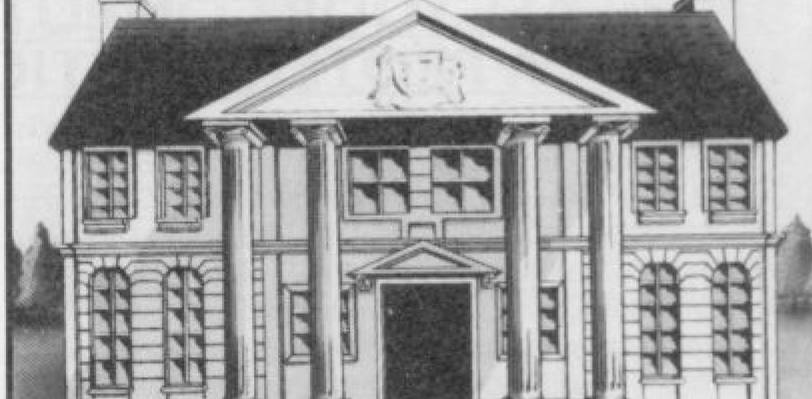
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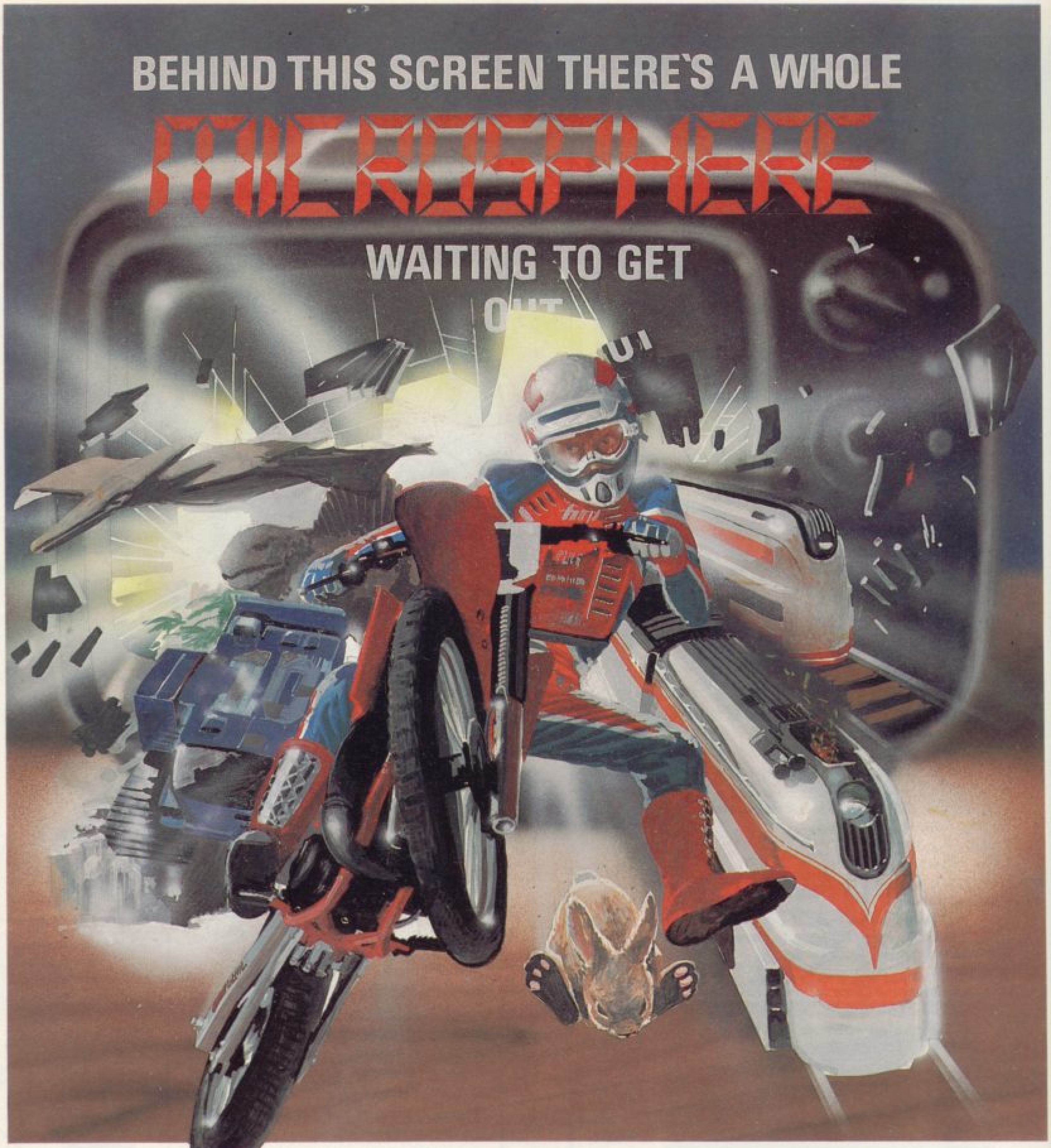
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Sharp ascent of The Pyramid

Nicole Segre talks to Bob Hamilton

TO SAY that things move fast in the software industry is scarcely a revelation but Bob Hamilton's career in the last year is a striking illustration of that oft-repeated fact. Since April he has transformed himself from a small cog in the wheels of a large, well-established company into a best-selling games author, co-director of a flourishing software company and, in his own words, "a very lucky man."

The program for which Hamilton, now 28 years old, is best-known is **The Pyramid,** which has loomed large on the software charts since it was released in October. Described by its author as an arcade-style adventure, the game presents the player with 120 chambers stacked in pyramid formation and inhabited by a variety of monsters such as extra-terrestrial tweezers, galactic strawberries and mutant eyes.

The player's aim is to guide the hero Ziggy in his exploratory capsule from the top level of the pyramid down to its base, zapping the aliens in each chamber with his little laser and collecting the crystal which will enable him to escape through one of the exits into the chamber below.

Several aspects of the game make it one to be played for hours, if not days or weeks. Once you have negotiated the 15 levels successfully, each more difficult than the last, you can play again to improve your score by achieving the same feat in a shorter time, or concentrate on choosing a different route through the chambers with their varying sets of weird and wonderful aliens.

Whenever you have dealt with one chamber, the screen displays a picture of the outside of the pyramid, with your position shown in red — not only a useful guide but a convenient pause in which to rest or perhaps take refreshment before resuming play. Completing the pyramid also gives you a series of numbers which make up a puzzle, with a cash prize offered for the first players to send the missing numbers.

Finally, as in his earlier games, Hamilton has incorporated a code, which only he can interpret, to check the authenticity of the high scores players claim to have achieved.

The pyramid formed the peak of a brief climb in programming which began when Hamilton decided to buy his two younger brothers, then aged 14 and 16, a Spectrum. At the time he was working on the software of an aircraft databus project at Smiths Industries Aerospace and Defence, just outside Cheltenham. Because of a holiday he had planned which failed to materialise, he was at home for two weeks and began to play with the Spectrum. "I was amazed," he says. "I thought it was just as good as all the advanced computer equipment I was using at work."

He was less impressed, however, with the standard of the games he had also bought for his brothers and was soon convinced that he could do better.



Less confident of his business abilities than of his programming, he suggested to a friend and colleague, Paul Dyer, that the two of them form a partnership to market Spectrum software.

The result was the new firm of Quest, formed in April, 1983, which later changed its name to Fantasy Software. Hamilton's first production for the fledgling company was a game called **Black Hole,** which he followed with a second called **Violent Universe.** Both were simple arcade game of the space invaders type and both sold steadily without creating a great sensation.

It was the appearance of a smash hit from the new firm of Ultimate in the summer of 1983 which made Hamilton change course. The game was **Jet-Pac** and the quality and smoothness of its graphics convinced Hamilton that he would have to produce something more complex, with more sophisticated graphics techniques, if he was to make a real impact on the market.

"I started with the idea of a pyramid," he says, "and the game grew from there." He acknowledges freely that his two brothers, his girl friend, his girl friend's flatmate, his partner Dyer, and their secretary Anne all contributed suggestions, encouragement and sustaining cups of tea towards the successful completion of the game.

While the graphics of The Pyramid are accomplished, Hamilton prides himself chiefly on the game's playability. Its sequel, **Doomsday Castle,** has, in the opinion of Dyer, less playability and superior graphics. In the same vein as The Pyramid, Doomsday Castle again stars Ziggy, who this time battles against the evil Scarthax, the Garthrogs, the Orphacs, the kamikaze Urks and the "phenomenally nasty" Googly bird.

Even Hamilton has difficulty in saving the universe from these fiends but he thinks that programming a game is a hindrance to playing it skilfully. "To be a good player," he says, "you need a good deal of concentration as well as enthusiasm. Once you have spent many laborious hours programming a game, much of the enthusiasm has gone."

From small beginnings, the firm of Fantasy Software has remained small and both directors plan to keep it that way. "We'd rather produce three or four really good games in a year and keep down our overheads than produce 30 or 40 games of which only one of two will really sell," says Dyer.

The company still consists only of the two partners, the secretary, and one full-time programmer, John White, employed in December to translate The Pyramid for the Commodore 64. Eventually the aim is for Fantasy to produce all its games for that machine and the Spectrum simultaneously.

One of the benefits of remaining small and informal is that it allows Fantasy to keep close links with its clientele. Several files in the Cheltenham office bulge with the letters received at the rate of around 80 a week from grateful young customers. The two directors also produce a newsletter which publishes, among other things, the high scores sent by the players of the various games, duly decoded and checked by Hamilton.

The firm's flexible structure also allows Hamilton to work whenever he chooses, a great advantage compared to his former life as a company employee. While Dyer handles sales, advertising, distribution and other such weighty matters during normal business hours,

Hamilton prefers to work late into the night — "my best time, he says is between 11pm and 2am" — saving a part of the day for running and other sporting activities.

"It is sad when you see people playing computer games or programming all day long," says Hamilton, who is a great believer in the healthy life. He likes to run anything between three or 50 miles a day over the local hills in training for various crosscountry events. He also once ran a 24-hour race, in which contestants run for a day and a night to see who covers the greatest distance, but so far has never taken part in a marathon. "Too short," he says. "They scarcely give you time to get started.

His new life also means that Hamilton can, say, work 14 hours a day for a spell of two months and then have time to enjoy his other favourite activities,

'Hamilton is convinced that keeping fit helps him to write programs'

potholing and mountaineering. He once tried hang-gliding but a crash on his first attempt discouraged him from further experiments. Most of his mountain climbing is done in North Wales, but the high spot, in both senses, of his year was climbing Mount Kenya at Christmas.



Hamilton is a vegetarian and is convinced that keeping fit helps him to write his programs. "I do some of my best work after a run," he says.

Exercise apart, Hamilton does not know to what his success as a programmer is due. He has a degree in mathamatics, but not computer science, and has never been able to draw. "The main thing," he says, "is to get the overall design right so that the game will be easy to program."

Both he and Dyer have high hopes of the next game, which they plan to release in September. It will be a "true adventure" starring Ziggy and possibly some friends, but no other details are being offered. "We cannot reveal more, in case anyone else beats us to it," says Dyer. In the meantime, Hamilton is working on a lighter arcade-style game called **Kondore,** with bird graphics inspired by his visit to Kenya.

Hamilton writes all his programs using a Spectrum and two Microdrives and has found that a perfectly adequate arrangement so far. "You do not need fancy hardware," he says. "You just have to push the machine to its limits." Nevertheless, he would not say no to Commodore 64 and is even more anxious to lay his hands on the new Sinclair QL.

"I think the QL will revolutionise the whole concept of computer games," he says. "It is very exciting but, at the same time, I can see myself regretting the days when you could write an excellent game for the Spectrum in a mere two months. The QL will be much more complex."

Hamilton believes he is an unusually fortunate man. He lives in a town he likes which is surrounded by splendid running country and earns a living by doing what he likes best whenever he chooses. Perhaps best of all is the fan mail and the idea that he is pleasing his public. "On Christmas Day, I woke up to the snowy slopes of Mount Kenya and thought of all the children who might at that moment be opening a parcel to find one of my games and I felt absolutely terrific," he says. "All in all, this has been the best year of my life.

If Hamilton's next games prove as popular as in the past, he should have many more happy times ahead.

Program	Last Month	Company	Memory
1 Atic Atac	1	Ultimate	48K
2 Lunar Jetman	8	Ultimate	48K
3 Stonkers	—	Imagine	48K
4 Manic Miner	—	Bug-Byte	48K
5 Chequered Flag	—	Psion	48K
6 Hunchback	—	Ocean	48K
7 The Pyramid	—	Fantasy	48K
8 Mr Wimpy	—	Ocean	48K
9 3D Ant Attack	—	Quicksilva	48K
10 Flight Simulation	—	Psion	48K

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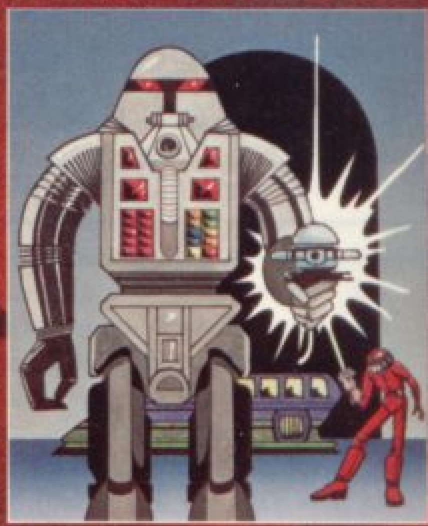


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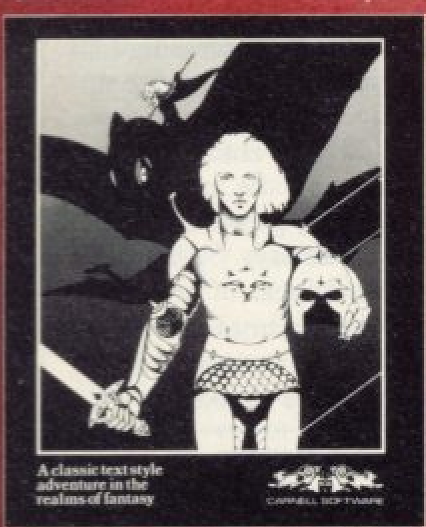


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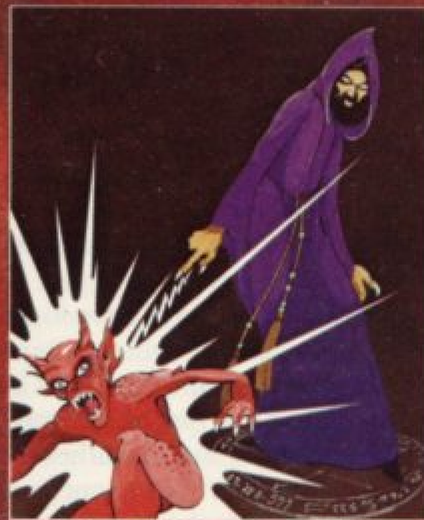
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THE DEVIL RIDES IN

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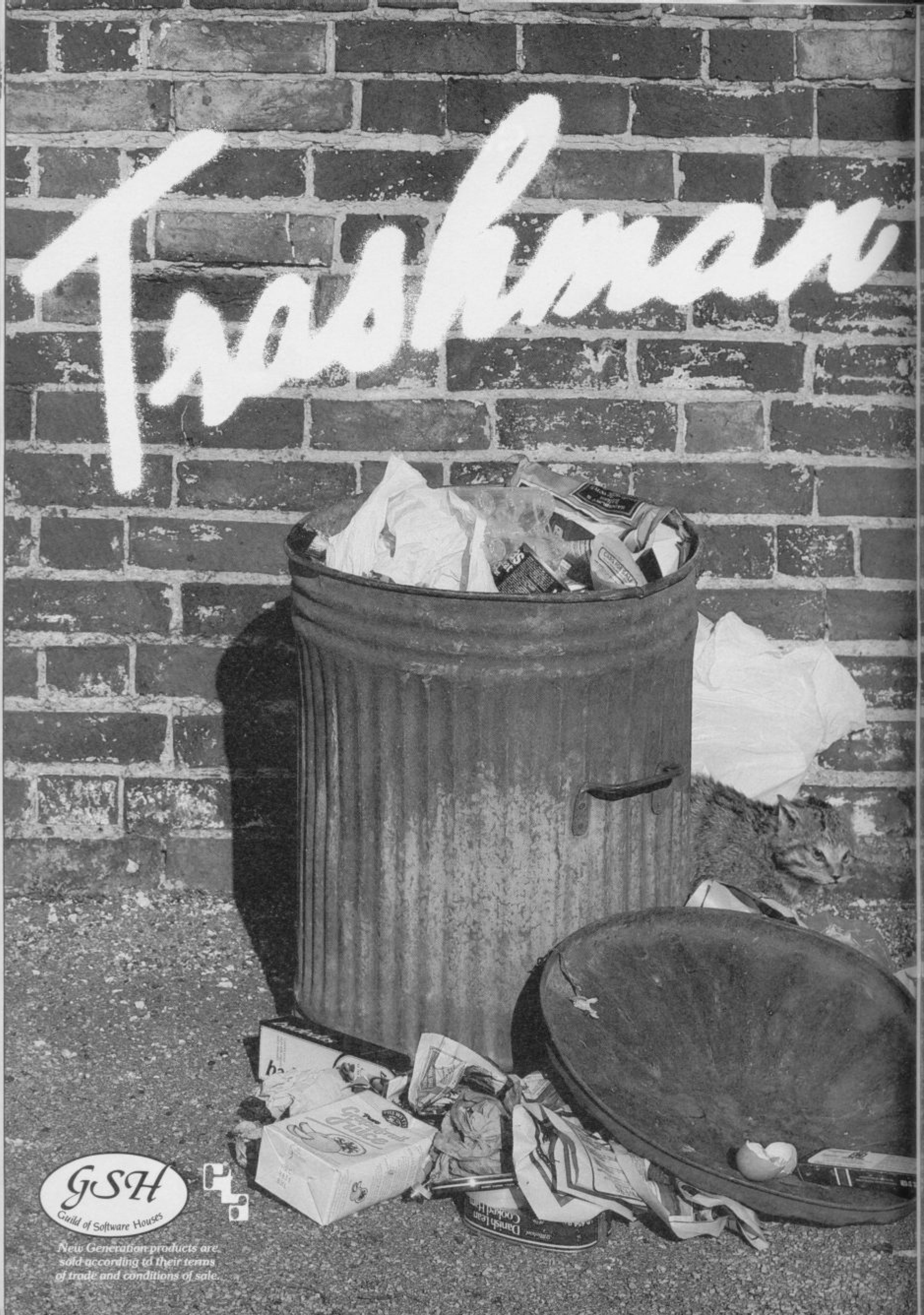
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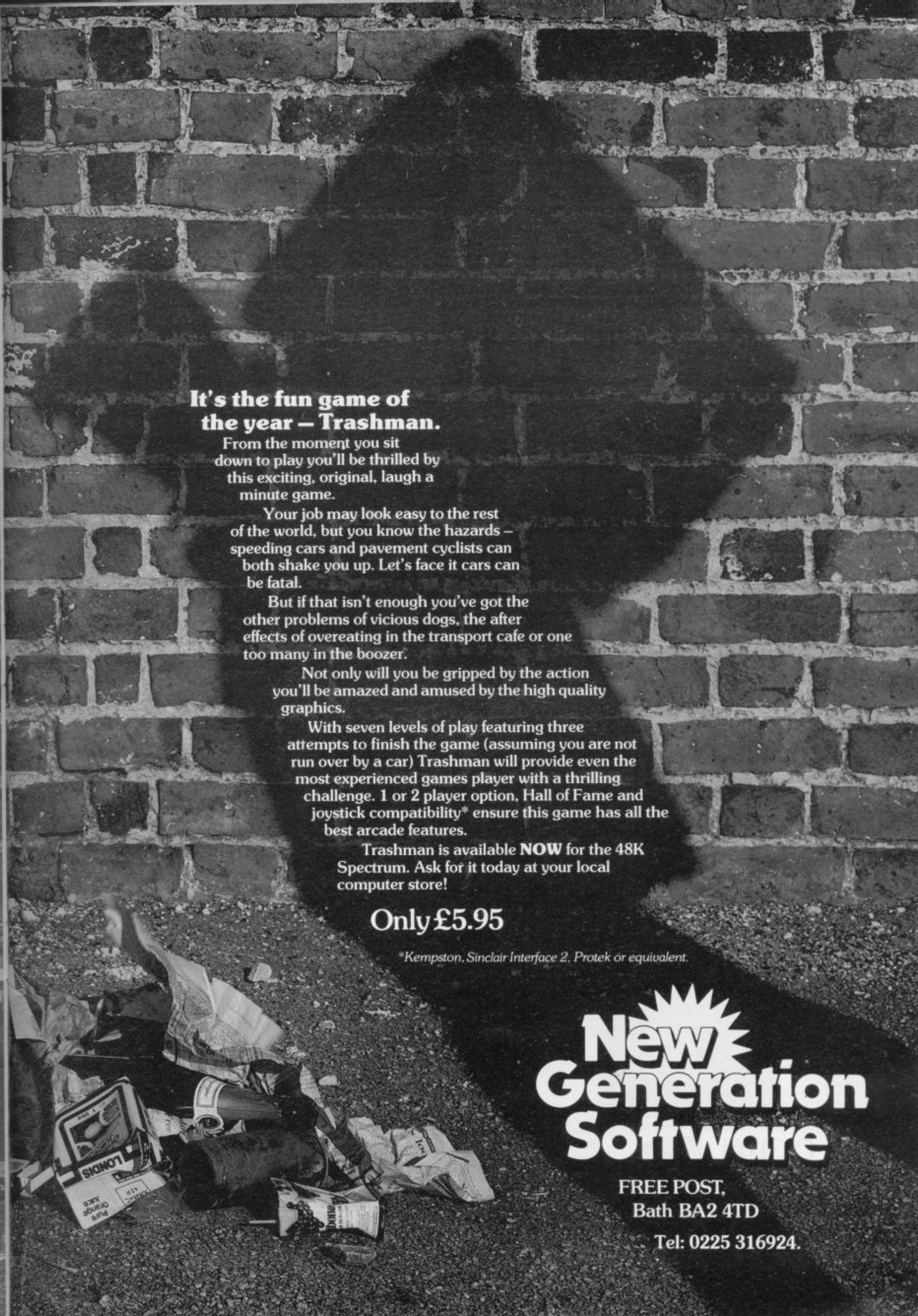
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Packages to help you help yourself

John Gilbert reviews the programming aids now available for the Spectrum

MOST PEOPLE buy computers with some purpose in mind. A few of them may want to learn about computing and to write programs. It is when that happens that utility routines may be needed to make the task easier.

There is a great variety of utilities available for the Spectrum which compensate for some of the inadequacies. One of the most common types of utility is the toolkit or language extension.

The **Spectrum Super Toolkit,** from Nectarine, provides all the necessary functions a Basic programmer would need. It is also very user-friendly and should help anyone who has the slightest interest in developing programs, no matter whether they be beginner or an expert.

The toolkit will run on the 16K and 48K machine and occupies approximately 2.5K. That means at least 6K on the 16K Spectrum will be available for user programs. That is an achievement for the author, who has included 12 routines in the package.

The exceptional characteristic of the Super Toolkit is the one-key entry system which invokes each of the 12 commands. All you have to do to use a command is hold down the ENTER key and press the command key, such as 'L' for list all variables.

The package is one of the most comprehensive on the market. As well as generating a full re-number of Basic programs, deleting blocks of lines, listing variables and showing the memory used by a program, it will also produce a map of the memory in the computer, including Microdrive and channel information, and read the tape header of any piece of code.

There are no complicated POKEs involved in making any of the utilities work. All you need is a RAND USR instruction to enable and to disable it. You will also have to use the keywords PRINT or REM to re-enable its facilities after running one of your programs.

You should have no difficulty using any of the routines, as the toolkit will produce prompts on the screen for information it needs to perform its work. For instance, when you ask for line renumbering the screen will clear and the computer will ask at which number you want your program lines to start. It will then ask for the step size between each line number. The automatic default, if you press ENTER for each of those prompts, is a line-numbering system starting at 10 and rising in stages.

The manual with the package is just as good as Super Toolkit. It explains each utility command in turn and on the back page provides an uncluttered index of how to access them. It also shows how to turn off the toolkit when you want to use interrupt-driven machine code routines in your programs.

Super Toolkit cannot be recommended strongly enough. It costs £9.95 and fills a big gap in the market.

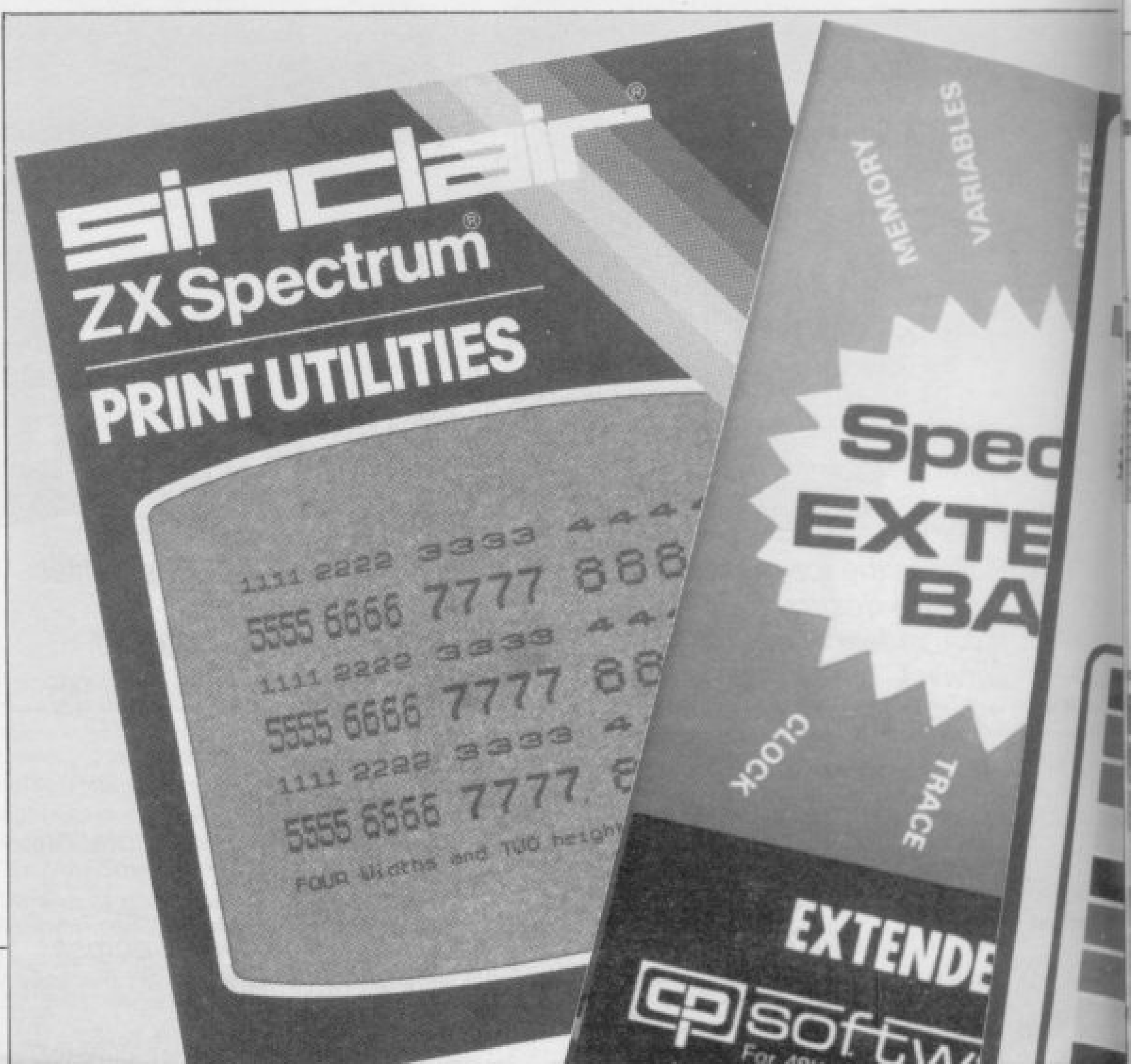
Spectrum Extended Basic, from CP Software, uses a one-keyword entry system similar to that of the Nectarine toolkit. Once invoked, all the user has to do is type an asterisk and then press the key to activate a desired command. For instance, the 'A' would be pressed if the user wanted to use AUTO line numbering.

The Basic uses approximately 5K of memory in which to operate. Although that is not bad for a package which allows the use of 10 new commands, when compared to the Nectarine product it takes much more memory.

The use of memory by a utility is all-important. A good utility will reside in memory almost invisible to the programmer, who should be able to do anything with the machine except initialise it, and it should utilise as little memory as possible, so that users can write long programs. A utility which uses a great deal of memory defeats its own purpose.

The Extended Basic could be described more accurately as another toolkit and not a set of machine code patch routines on the existing Sinclair Basic. It will operate with the Sinclair language but the routines included in the package are more in line with a toolkit than an extension of a high-level language.

It includes an auto-line number routine, a real-time clock, continuous scroll function, block code delete and an indication of the current state of the computer memory. It is almost as easy to use and as helpful as the Nectarine toolkit and many of its commands can be incorporated into user programs. Extended Basic is not a competitor to the toolkit but it is, however, a useful



companion package. Spectrum Extended Basic costs £9.95 and is expensive for what it offers.

The other type of utility which is helpful on the Spectrum is the graphics package. Although Sinclair Research included exciting graphics capabilities with the Spectrum, it is often difficult for the programmer working in Basic or the amateur programmer to get the most from the graphics potential.

One of the best ways to highlight a program or give it a title is to increase the size of the lettering and characters on the screen. It could be done with a number of PRINT statements but it is possible, using machine code or POKE routines, to magnify the original character set from the ROM.

A new utility package, **Print Utilities,** from Sinclair Research will allow you to magnify the character set and also to increase or decrease the width of lettering on the screen or on a printer. The software will allow you to use four widths and two heights.

There are two versions of the package, one for the 48K and one for the 16K, although each performs identical tasks. Once it has been initialised you can set up the character height and width using a print command which employs a hash. After that you must put a CHR$ command and a number. For instance:

PRINT 15; CHR$ 28

would select a double-height character set. Other CHR$ settings would give 32, 42, 16, and 21 characters a line and will also move the cursor left and right and clear the screen.

The different-sized character sets can be used in programs but they can also be used to reproduce listings to make them easier to read. Unfortunately the manual infers that the package is set up for the ZX printer, although with Interface One, which is catered for, output to a dot matrix printer or daisywheel would be possible, using the correct software.

Output to a printer is more difficult than to a screen, as the double-height mode is cancelled after one line is printed and it is not possible to mix different heights in one line of text.

Print Utilities can be obtained for the 48K Spectrum and costs £9.95. For the usefulness of the product that is expensive.

Paintbox is a more powerful graphics utility for the 48K Spectrum. It includes the capacity to manipulate 84 user-definable graphics which are set up in four switchable memory banks. Any one of the four sets can be switched into the 'present' mode, taking the place of the letters A to U.

It is possible to change any of the example characters set up in the package and to save them on tape if you want to use them in your Basic or machine code programs.

Paintbox contains a special facility which enables the user to put several UDG graphics on the screen together to examine the effect. It is also possible to rotate, inverse, and mirror the graphics with the press of a key.

Another facility is the precision plotter, which will allow you to draw pictures on the screen using lines, circles and arcs. The pictures can be shaded with a selected colour and the colour for INK and PAPER can be changed. The utility looks like the one on the Sinclair Horizons tape, although it is set out slightly better and is more usable so far as Basic programming is concerned.

> 'It is often difficult to get the most from the graphics potential'

The screen planner uses a combination of UDG graphics which can be created using the UDG banks and the Precision Plotter.

It allows you to see the finished result of all your work. The package is a powerful graphics aid and, if the demonstrations are any criterion both in the manual and on the tape you could produce some professional screen displays. It is possible for even a beginner to draw reasonable pictures using the package. Paintbox can be obtained from Print and Plotter and costs £7.50.

There are still few utility packages available for the Spectrum and the computer has been on the market for nearly one-and-a-half-years. It seems that most software companies are concentrating on producing arcade games of one kind or another. That is unfortunate, as many Spectrum owners could produce original and interesting programs if they had access to more utilities. It might also encourage more people to start programming if they see what can be done with the utilities available.

Some people may say that it is a little late to start thinking of producing more utilities for Spectrum owners but there are still many users trying to find interesting things to do with a computer. It would certainly be helpful if the few utilities on the market at present became many in the near future.

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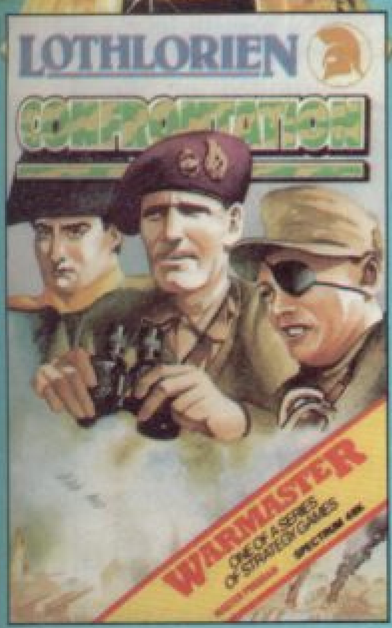
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IF YOU THINK YOU'VE GOT THE BETTER OF YOUR COMPUTER, YOU'D BETTER THINK AGAIN....

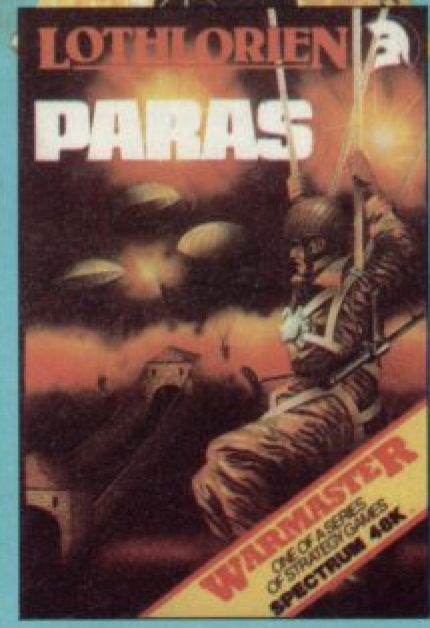
We all enjoy a good action game on our home computers, but after a while doesn't chasing the alien across a screen wear a little thin? That's the time to take on the superior challenge of a Warmaster strategy game — plenty of action, plenty to think about, and plenty of titles to suit every taste.

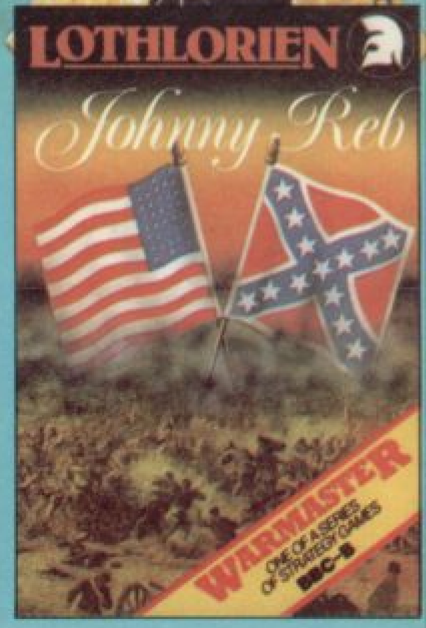
Take on Warmaster and really put your home computer through its paces.











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Access

What's cooking?

Gourmet Steve Williams provides food for thought with his recipes for the Spectrum. Liz Leckie reports

SPECTRUM enthusiast Steve Williams has given a new meaning to the phrase menu-driven program. In his quest to make the micro as essential a kitchen gadget as the potato peeler, he has developed a system which could make galloping gourmets everywhere throw away their cookbooks.

His new software range of computer cookbooks uses a menu-driven—Williams prefers ingredient-driven—program to allow harassed housewives to find a recipe to fit every taste, using favourite ingredients or awkward left-overs.

Delicious concoctions like Prawns Louisiana, honey oatmeal bread and yummy date salad can be called up to make menus fit for any occasion. The revolutionary system is the result of only one month's hard work by Williams, his wife Marisa and his brother and sister-in-law.

"I bought my Spectrum 48K six months ago," says Williams, a 30-year-old personnel officer for a computer firm in Leeds. "While I do not have a technical background, I had borrowed micros previously and knew a little about them. I bought a Spectrum because it seemed about the best buy. Also we had the idea of producing software and we thought it was one of the most popular computers."

Now he has produced a series of three tapes, each with more than 70 recipes, which he is marketing under the title **The Computer Cookbook.**

"The most difficult job was finding the recipes, checking and testing them, and then feeding them into the computer. It was a month of very hard work," he says.

"The recipes are ingredient-driven and the cookbook can be used in two ways. It can be a straightforward recipe book in which the program lists all the dishes and you can choose which recipe you would like to read; or you can select up to five from a list of 30 ingredients, like beef, eggs or wine. The program will then search every recipe looking for those, using the ingredients you have chosen."

So a cook with a heap of prawns to use can turn to the Continental tape and find recipes for mouth-watering meals, including cod in seafood, savoury rice with fish paella, prawn-filled pancakes, or Lisbon soup.

The program, all in Basic, also allows the cook to choose whether cooking instructions should be for a gas or electric oven and it gives the option of measurements in Imperial or metric terms.

Perhaps the most unusual and useful aspect of the idea is the details of quantities of the ingredients of each recipe. As it is called up, the cook can tell the computer how many—any number up to eight—for whom the meal is intended. The computer will then adjust the quantities accordingly, saving time-consuming calculations and costly errors.

"Some of the people we know use the tapes like a shopping list. It works out the quantities and saves buying too many ingredients," Williams says.

He believes that anyone sufficiently interested in computers to own a printer



would be able to take hard copies of individual recipes to use as shopping lists, although no printing commands are incorporated in the program.

Altogether, Williams tried and tested more than 200 recipes for The Computer Cookbook, which includes a tape using wholefoods and a Quick Cook tape, as well as the more exotic Continental section.

Looking at the list of delicious dishes, like tarragon artichokes or herring kebabs, as it appears on the screen can make even the laziest people feel like rushing to the cooker.

"We asked a number of people for their trusted recipes and we tried to select as many unusual dishes as possible. We had to check them all carefully once they were keyed-in. One recipe noted 'add 4 oz. salt', which certainly would have created a yoghurt surprise," he says.

He and his family have stayed slim, despite a month of intensive recipe testing. "I enjoy cooking and my wife and I share doing it. We have found the tapes a great help, particularly the Quick Cook tape, which we wrote first," he says. "You can go home at night and if you do not know what to make, you can find ideas quickly."

One difficulty he faced was fitting all the information into the Spectrum 48K memory. "We were limited by the memory and had to keep the recipes to the bare essentials. There was so much possible data and we had to be very selective."

Each of the tempting dishes has a page to itself and an important factor in drawing up the program was the page design. "We designed each page layout to be clear and easily understood," Williams says.

Now each recipe can be read at a glance and has cooking and preparation times marked clearly. Simplicity is the keynote of the system, as Williams hopes it will be used even by people who know nothing about computers.

"You do not need to understand the software to use the program. All you need to do is load the tape and follow the instructions. We hope it will encourage people to use computers properly and not just play games."

Williams and his wife, who live in a rural belt just off the A1 at the tiny village of Pick Hill, near Thirsk in Yorkshire, are an example of how to bring self-sufficiency and the good life into the micro age. They own nearly three-quarters of an acre round their home—which they converted from a former station house—grow all their vegetables and keep hens.

"We bought the house as a wreck four years ago. We doubled the size, doing all the building work ourselves," he says.

Despite driving 90 miles a day to work and back and keeping the garden

under control, Williams still finds time to be bursting with ideas on how to apply his Spectrum to the everyday problems of life in the country. He is working on programs to help with crop rotation in the garden and also one to monitor egg production.

Eventually Williams, who graduated from Lancaster University in politics and psychology, hopes to set up a family business marketing software.

"I think computers fit very well into our way of life. It is like going back to cottage industries. You can live on a self-sufficient basis, using computers to work from home. It is happening all over as computers spread and take people out of the office environment. They can stay at home and work from the terminal."

Already Williams has sold some 60 cookbook tapes, without advertising. Now, using professional help to duplicate the tapes, he is hoping to interest the big software retailers in his product.

"If you are to run a small mail order business you have all the problems of delivery. I think it is worth selling through the big shops," he says.

At present, anyone interested in buying the tapes, costing £5.95 each or £14.95 for the set, can contact Williams at Station House, Pick Hill, Thirsk, North Yorkshire or telephone him on 0845 567415.

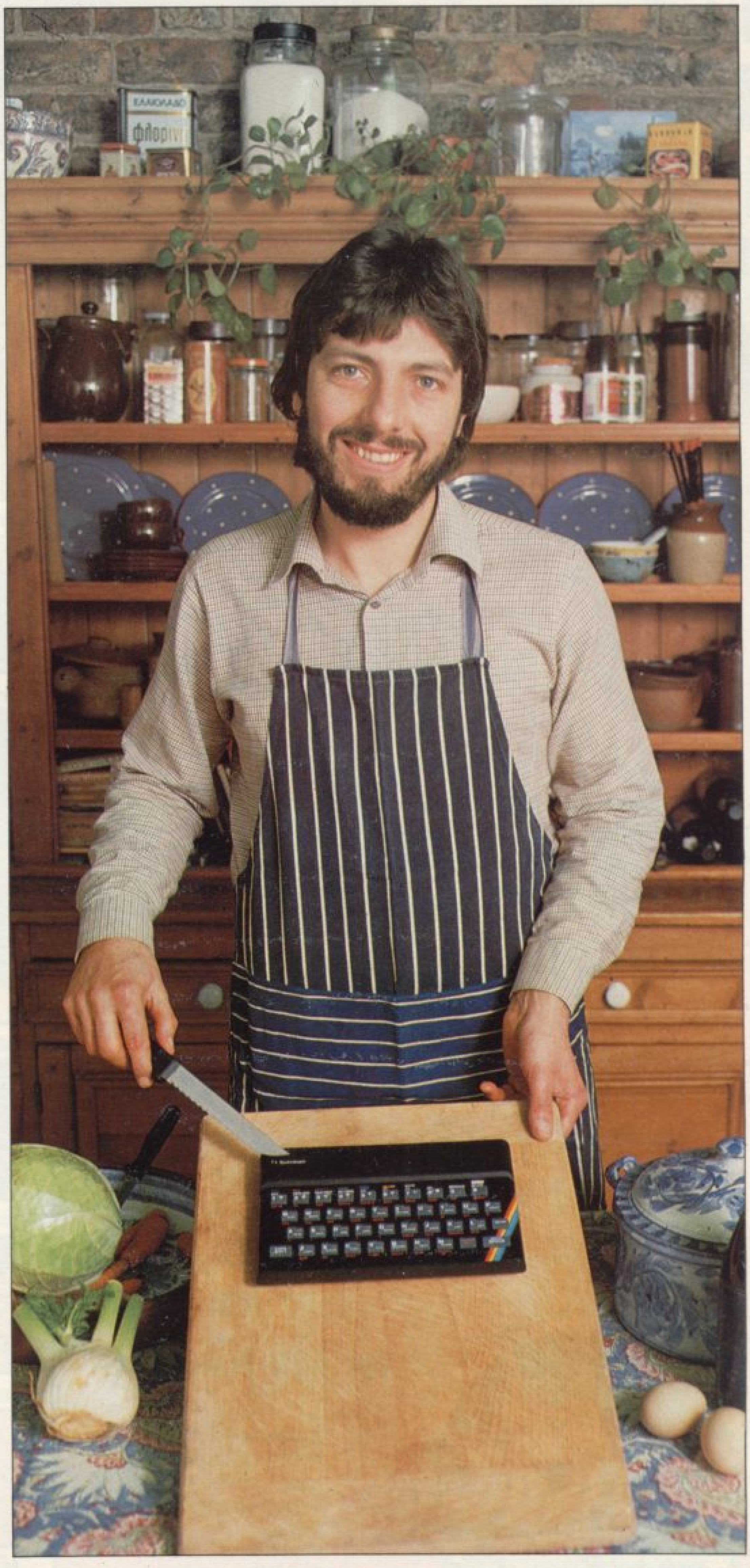
When the Sinclair Interface One system becomes widely available he is hoping to modify the programs for use with a Microdrive for instant loading—at present the program takes nearly five minutes before it is ready—and for vastly-increased data storage. He is also planning to buy a Sinclair QL and to produce software for it.

"Given our experience of business and personnel work we hope to try our expertise in the commercial world, as well as producing software for the Spectrum which is not purely games orientated," he says.

His first interest is in ideas for the home, like an autodialler for the telephone using the Spectrum interface system. With the faster access to data, the user could call a number by keying in a name.

For this far-sighted Sinclair user, all that is just a start. "We would like to build a complete home system, including a home freezer program which would tell you what is in the freezer, how long it has been there, and how it can be used.

"With better luck the computer will be a part of everyone's kitchen and certainly a part of their homes."



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You might win more than £100 worth of prizes if you can solve

The Puzzle of the Pirated Software



IN CONJUNCTION with Melbourne House, *Sinclair User* is giving away hundreds of pounds worth of prizes in our devilishly difficult Sherlock Holmes competition.

The five first prizewinners will each receive more than £100 worth of software and books from Melbourne House. They will be given all the classic Spectrum software — **The Hobbit, Penetrator, Terror Daktil, Classic Adventure, Spectrum Forth, Melbourne Draw** and the two recent releases, **Sherlock Holmes** and **Hurg.** In addition the winners may choose any three books from the following: **Over the Spectrum, Spectrum Machine Language for the Absolute Beginner, Understanding Your Spectrum, The Complete Spectrum ROM Disassembly, Spectrum Hardware Manual, Spectrum Microdrive, Supercharge Your Spectrum,** and **Spectrum Exposed.**

We are also awarding 25 runners-up prizes of the Sherlock Holmes Spectrum game, each one normally retailing for £14.95.

To enter the competition, first read the short story below and then endeavour to discover the clues which Sherlock Holmes perceived unerringly. When you think you have deduced the identity of the thief, complete the entry form below and post it to Sinclair User, 196-200 Balls Pond Road, London N1 4AQ, to arrive not later than April 30, 1984.

Employees of ECC Publications and Melbourne House are ineligible and the editor's decision is final. The solution to the puzzle will be given in the June issue of *Sinclair User.*



HERE IS an extract from the memoirs of Dr Watson:

The various investigations on which I was fortunate to accompany Sherlock Holmes, the grandson of the famous detective, frequently left me baffled and bewildered, though to Holmes the confusion of alibis, clues and lies always appeared crystal clear. One such instance was the Peculiar Puzzle of the Pirated Software.

One April morning, Holmes and I were summoned to the offices of Classic Software Ltd, where a break-in had been discovered. On arrival we were met on the first floor by Mel Bourne, the manager. Visibly agitated, he led us into his office, where the three members of his staff were assembled.

"I was first to arrive this morning and discovered the break-in immediately. I ordered my staff not to touch anything and I telephoned you." Bourne indicated his desk. "The locked drawer has been levered open and ransacked and you can see how the thief broke in."

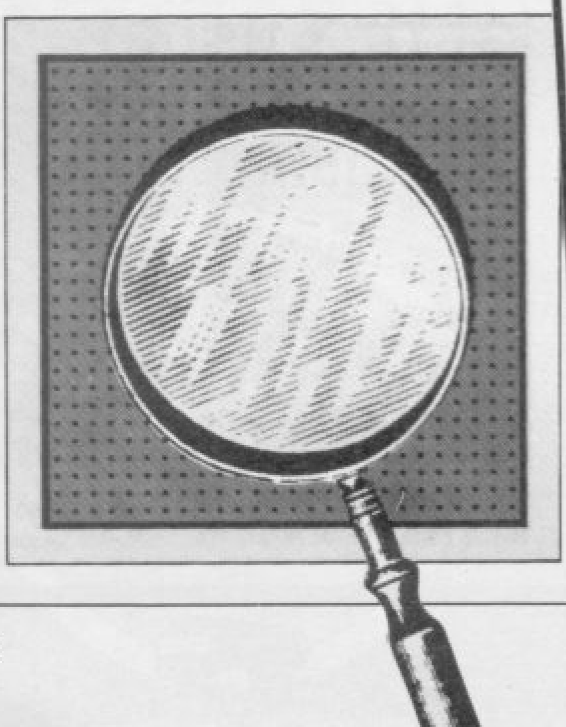
Holmes' piercing eyes swept the room, taking in the rifled desk and the broken window behind it. Through the smashed pane he could see the fire escape outside, littered with shards of glass.

"Interesting," he mused. "Tell me, what appears to have been stolen?"

"That's just it," exclaimed the exasperated Bourne. "Absolutely nothing. The only thing of value was this" — and he held up a cassette. "Our latest game. Our rival, Moriarty Micros, would pay a small fortune to get their hands on this."

"Perhaps they did," I interjected, "and merely substituted another cassette."

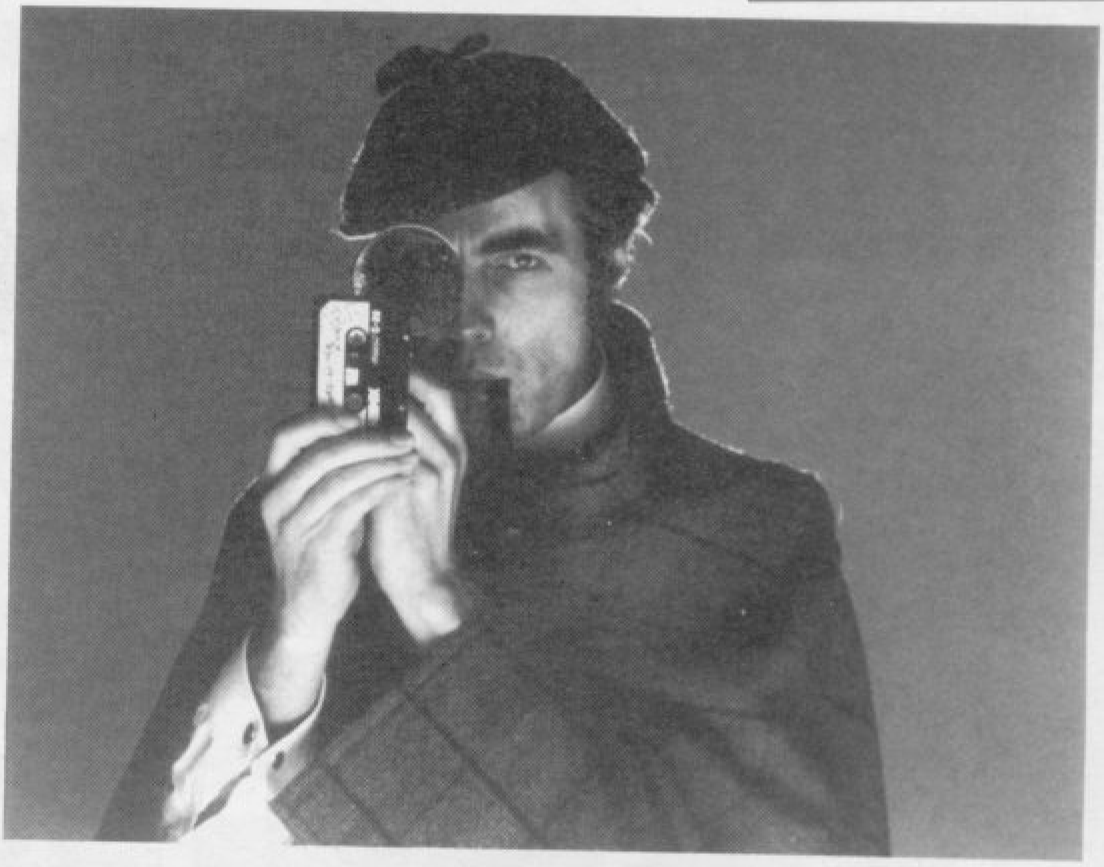
Holmes slapped me on the back.



"Brilliant, Watson. You have a mind like a rapier. I suggest we load the tape into the office Spectrum without further ado."

Bourne's secretary, Penny Traitor, led the way to the computer room. An untidy mound of hardware and software, trailing wires and cables, covered the table. Moving a pile of blank cassettes to one side, Holmes idly picked up the Spectrum and put it down again hurriedly. It was surprisingly hot.

"I'll get Terry Dactill, our programmer, to load it for you. I'm all fingers and thumbs when it comes to computers," Miss Traitor confessed and she turned to the bespectacled Dactill, who placed the cassette swiftly in the tape deck, rewound it and began the loading procedure. While we waited Dactill related the events of the previous afternoon.



"At about 4.30 I had put the final touches to the game and I called the others in to see it. The four of us played it for almost an hour. It's very addictive, I'm proud to say."

"I'll second that," added Horace Goezski, the public relations man. "It's a kind of snakes and ladders thing called Lord of the Rungs. Damnably tricky, too; I was hopeless at it."

Dactill took up the story again. "At 5.30 we decided we had better go home and, after rewinding the cassette, I gave it to Mel for safe keeping. The others followed him into his office and stood chatting while I unplugged the equipment in here."

Bourne nodded. "That's correct. I locked the cassette in my desk — normally I use the safe but as we were late I put it in the top drawer and removed the key. Terry joined us and we all left the building together, Penny locking the main door behind us."

The cassette had finished loading by this time and within minutes of running it was clear that it had not been altered in any way. As the game ended the hi-score chart was displayed. It read.

MEL	11073
TER	9912
HOR	7231
PEN	654

Holmes took out his pipe and lit it, as he was accustomed to do when he had found the solution to a crime.

"One final question," he said. "Who has keys to the building?"

"Myself, and Terry," replied Bourne. "Why do you ask? It seems we have been wasting your time, as nothing appears to have been taken after all."

Sherlock Holmes looked up and said, gravely: "I'm afraid you're wrong. A theft has occurred and I'm confident that at this moment Moriarty Micros is duplicating Lord of the Rungs by the thousand."

"Good grief, Holmes," I spluttered. "How on earth do you know that?"

Holmes turned to me and, in the manner of one speaking to a child, said, "Elementary, my dear Watson . . ."

SHERLOCK HOLMES COMPETITION ENTRY FORM

I have deduced that the thief is ....

My reasons are as follows (please use an extra sheet of paper if necessary) ....

....

....

....

....

....

....

If I win first prize, the three books I would like are ....

....

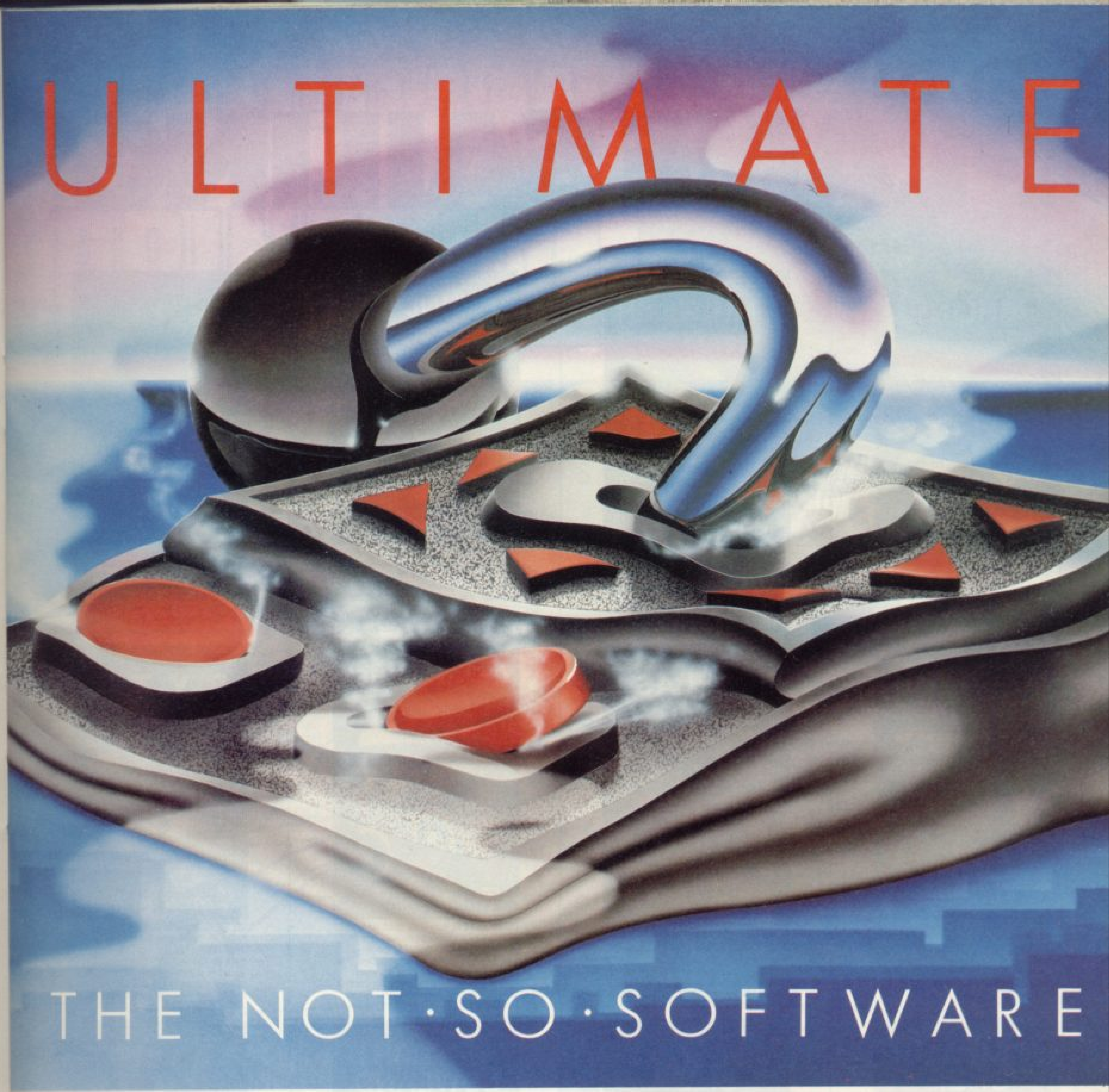
....

Name ....

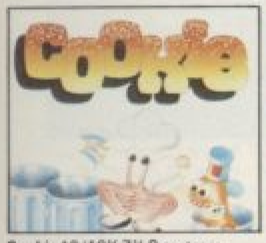
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Ultimate Play The Game is a trade name of Ashby Computers and Graphics Ltd., The Green, Ashby de la Zouch, Leicestershire, Tel (0530) 411485. Dealer enquiries welcome.

PROGRAM PRINTOUT

Instructions for graphics characters are printed in lower-case letters in our listings. They are enclosed by brackets and separated by colons to distinguish them and the brackets and colons should not be entered.

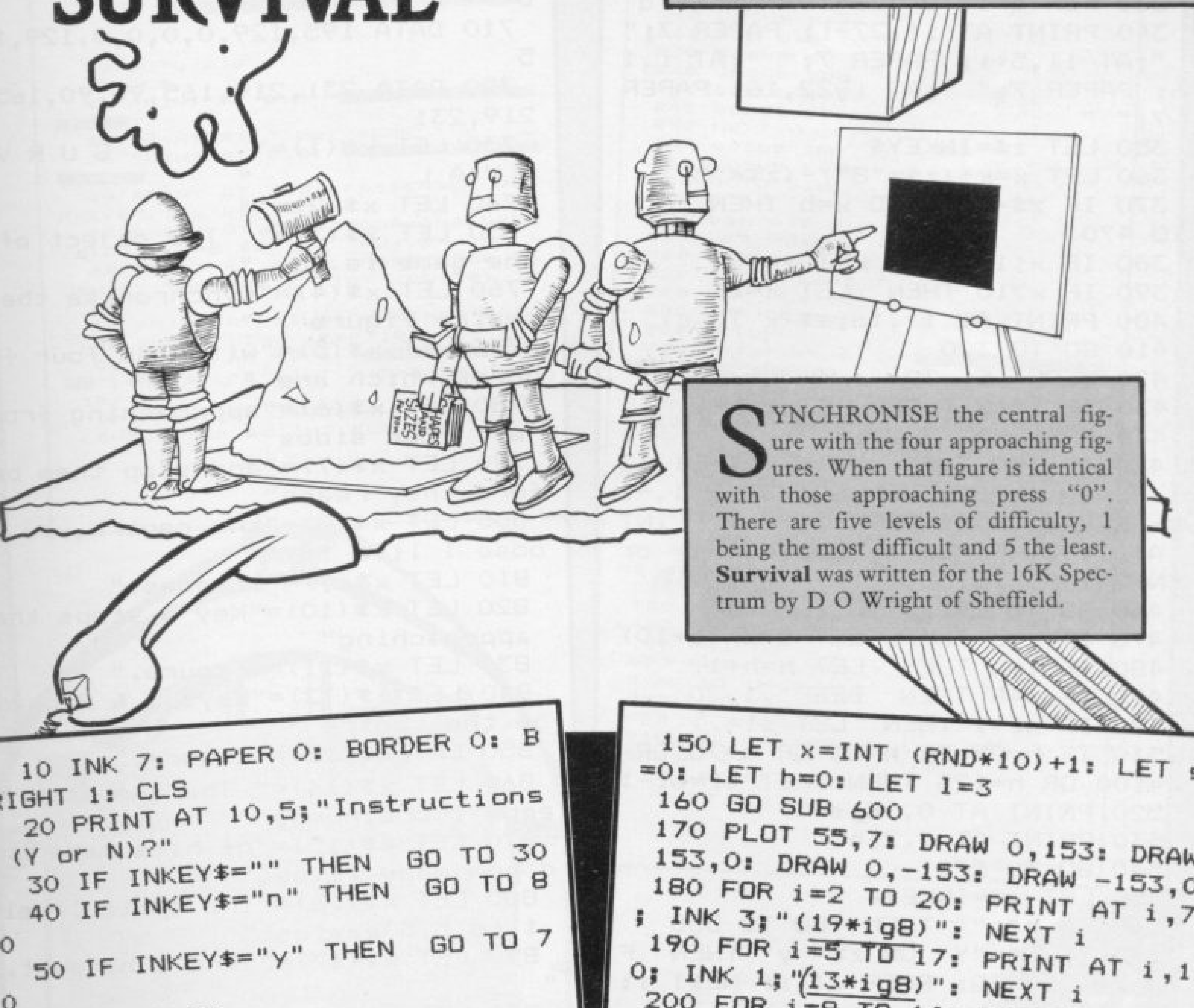
Inverse characters are represented by the letter "i" and graphics characters by "g". Thus an inverse W would be represented by "iw", a graphics W by "gw", and an inverse graphics W by "igw".

Spaces are represented by "sp" and inverse spaces by "isp". Whenever any character is to be used more than once, the number of times it is to be used is shown before it, together with a multiplication sign. Thus "6*isp" means six inverse spaces and "(g4:4*i4:g3)" would be entered as a graphic four, followed by an inverse four repeated four times, followed by a graphics three.

Where whole words are to be written in inverse letters they appear in the listings as lower-case letters. Letters to be entered in graphics mode on the Spectrum are underlined.

Inverse characters may be entered on the ZX-81 by changing to graphics mode and then typing the appropriate characters and on the Spectrum by changing to inverse video and typing the appropriate letters. Graphics characters may be entered on the ZX-81 by changing to graphics mode and then pressing symbol shift while the appropriate characters are entered. On the Spectrum graphics characters may be obtained by changing to graphics mode and then pressing the appropriate character. User-defined graphics will appear as normal letters until the program has been RUN.

SURVIVAL



SYNCHRONISE the central figure with the four approaching figures. When that figure is identical with those approaching press "0". There are five levels of difficulty, 1 being the most difficult and 5 the least. **Survival** was written for the 16K Spectrum by D O Wright of Sheffield.

```
  10 INK 7: PAPER 0: BORDER 0: B
RIGHT 1: CLS
  20 PRINT AT 10,5;"Instructions
 (Y or N)?"
  30 IF INKEY$="" THEN  GO TO 30
  40 IF INKEY$="n" THEN  GO TO 8
0
  50 IF INKEY$="y" THEN  GO TO 7
0
  60 GO TO 30
  70 DIM x$(20,32): GO SUB 730
  80 CLS : PRINT AT 10,2;"Enter
skill level"
  90 LET q$=INKEY$
 100 IF CODE q$<49 OR CODE q$>53
 THEN  GO TO 90
 110 CLS : PRINT AT 10,2;"Skill
level:"; FLASH 1;q$
 120 BEEP .5,0
 130 LET sl=VAL q$
 140 CLS
 150 LET x=INT (RND*10)+1: LET s
=0: LET h=0: LET l=3
 160 GO SUB 600
 170 PLOT 55,7: DRAW 0,153: DRAW
 153,0: DRAW 0,-153: DRAW -153,0
 180 FOR i=2 TO 20: PRINT AT i,7
; INK 3;"(19*ig8)": NEXT i
 190 FOR i=5 TO 17: PRINT AT i,1
0; INK 1;"(13*ig8)": NEXT i
 200 FOR i=8 TO 14: PRINT AT i,1
3; INK 2;"(7*ig8)": NEXT i
 210 PRINT AT 11,7; INK 7;"(19*i
g8)"
 220 FOR i=2 TO 20: PRINT AT i,1
6; INK 7;"(ig8)": NEXT i
 230 PRINT AT 11,16; FLASH 1; PA
PER 2;"(ig8)"
 240 PRINT AT 0,12;"SCORE=";s
 250 PRINT AT 6,1;"HITS";AT 7,2;
h
```

Continued on page 68

Continued from page 67

```
 260 PRINT AT 6,27;"LIVES";AT 7,
29;l
 270 LET i=1
 280 LET a$="abcdifhejg"

 290 LET b=INT (RND*10)+1
 300 LET i=i+1: IF i=12 THEN  GO
 TO 420
 310 PRINT AT 11,27-i;a$(b);AT 1
1,5+i;a$(b);AT i,16;a$(b);AT i-2
2,16;a$(b)
 320 BEEP .02,i
 330 FOR q=1 TO (sl*10): NEXT q
 340 PRINT AT 11,27-i; PAPER 7;"
 ";AT 11,5+i; PAPER 7;" ";AT i,1
6; PAPER 7;" ";AT i-22,16; PAPER
 7;" "
 350 LET z$=INKEY$
 360 LET x=x+(z$="8")-(z$="5")
 370 IF z$="0" AND x=b THEN  GO
TO 470
 380 IF x<1 THEN  LET x=10
 390 IF x>10 THEN  LET x=1
 400 PRINT AT 11,16;a$(x TO x)
 410 GO TO 300
 420 BEEP .5,-30
 430 IF i=12 THEN  LET l=l-1
 440 PRINT AT 7,29;l
 450 IF l=0 THEN  PRINT AT 11,12
; FLASH 1;"GAME OVER": BEEP 1,-1
0: BEEP 1,-20: BEEP 1,-30: PRINT
 AT 11,8; FLASH 1;"ANOTHER (Y or
 N)?": GO TO 550
 460 GO TO 270
 470 IF x=b THEN  LET s=s+(b*10)
 480 IF x=b THEN  LET h=h+1
 490 IF x=b THEN  BEEP .1,20
 500 IF sl=1 THEN  LET sl=.1
 510 IF h=25 OR h=50 OR h=75 OR
h=100 OR h=125 THEN  LET sl=sl-1
 520 PRINT AT 0,18;s
 530 PRINT AT 7,2;h
 540 GO TO 270
 550 LET z$=INKEY$
 560 IF z$="" THEN  GO TO 550
 570 IF z$="Y" OR z$="y" THEN  F
OR i=1 TO 10: BEEP .1,i: NEXT i:
 GO TO 80
 580 IF z$="N" OR z$="n" THEN  F
OR i=10 TO 1 STEP -1: BEEP .1,i:
 NEXT i: CLS : PRINT AT 10,3;"SE
E YOU SOME OTHER TIME !": PAUSE
100: STOP
 590 GO TO 550
 600 RESTORE 630
 610 FOR a=USR "a" TO USR "k"-1:
 READ c: POKE a,c: NEXT a
 620 RETURN
 630 DATA 255,255,195,195,195,19
5,255,255
 640 DATA 255,129,189,165,165,18
9,129,255
 650 DATA 0,0,60,60,60,60,0,0
 660 DATA 231,195,129,24,24,129,
195,231
 670 DATA 153,90,60,255,255,60,9
0,153
 680 DATA 129,66,60,60,60,60,66,
129
 690 DATA 255,231,231,129,129,23
1,231,255
 700 DATA 0,24,24,126,126,24,24,
0
 710 DATA 195,129,0,0,0,0,129,19
5
 720 DATA 231,219,165,90,90,165,
219,231
 730 LET x$(1)="          S U R V
I V A L       "
 740 LET x$(2)=""
 750 LET x$(3)="  The object of
the game is to  "
 760 LET x$(4)="synchronise the
centre figure    "
 770 LET x$(5)="with the four fi
gures,which are "
 780 LET x$(6)="approaching from
 all four sides "
 790 LET x$(7)="and stop them be
fore they reach"
 800 LET x$(8)="the centre,you l
oose 1 life if "
 810 LET x$(9)="it does."
 820 LET x$(10)="Key 0 stops the
 approaching"
 830 LET x$(11)="figure."
 840 LET x$(12)="Keys 5 & 8 chan
ge the centre "
 850 LET x$(13)="figure."
 860 LET x$(14)=" The computer k
eeps score,number"
 870 LET x$(15)="of hits made an
d how many lives."
 880 LET x$(16)="The skill level
 1 to 5,5 easiest"
 890 LET x$(17)=" and 1 hardest.
"
 900 LET x$(18)="The skill level
 becomes harder   "
 910 LET x$(19)="every 25 hits."
 920 LET x$(20)="     G O O D  L
U C K ! ! !"
 930 CLS : FOR n=1 TO 20: FOR i=
1 TO 32: FOR q=1 TO 2: NEXT q: P
RINT x$(n,i TO i);: NEXT i:: NEX
T n
 940 PRINT AT 21,2; FLASH 1;"Pre
ss any key to start game "
 950 PAUSE 0: CLS : RETURN
```

BUSMAN

YOU are in charge of a county's bus services for five years in **Busman,** written for the 16K ZX-81 by J Lowther of Heywood, Lancs, for the *Sinclair User* Christmas Competition.

The information relating to the finance, patronage and fares for the previous year is given. You can use it to determine the levels of fares and service increases. The aim is to increase patronage with lower fares and to survive on a lower grant. After the five-year period, an overall assessment is given.

```
   2 REM 10-140
              "DISPLAY RESULTS"
   3 REM 200-300
                     "CONTROL"
   4 REM 500-550
                  "INITIALISE"
   5 REM 700-995
           "POLICY DECISIONS"
   6 REM 1000-1070
                "NEW RESULTS"
   7 REM 2000-2150
          "ANALYSIS/NEW GAME"
   8 REM 3000-3300
       "OPTIONS AFTER RESULTS"


   9 GOTO 210
  10 CLS
  11 PRINT AT 0,5;"      B U S M A
 N   "
  20 PRINT AT 3,22;"YEAR ";U
  30 PRINT AT 5,0;" **** RESULTS
 **** "
  40 PRINT AT 7,0;"PASSENGER JOU
RNEYS";TAB 20;INT (PJ);"M"
  50 PRINT AT 8,0;"(OAP/CHILDREN
/ETC.)";TAB 20;INT (PJ*.2);"M"
  60 PRINT AT 10,0;"PASSENGER RE
VENUE";TAB 20;"£";INT (PR*10)/10
;"M"
  70 PRINT AT 11,0;"EXPENDITURE"
;TAB 20;"£";INT (EXP*10)/10;"M"
  80 PRINT AT 12,0;"GRANT REQUIR
ED";TAB 20;"£";INT ((EXP-PR)*10)
/10;"M"
  90 PRINT AT 14,0;"AVERAGE FARE
 LEVEL";TAB 20;INT FL
 100 PRINT AT 15,0;"SERVICE LEVE
L";TAB 20;INT SL
 110 PRINT AT 18,0;"     PRESS "C"
 TO CONTINUE GAME     "
 120 IF INKEY$<>"C" THEN GOTO 12
0
 130 CLS
 140 RETURN
 200 SAVE "BUSMAN"
 201 PRINT AT 5,5;" *** B U S M
A N *** "
 202 PRINT AT 10,8;"HAS NOW";AT
15,5;" PRESS A KEY TO START "
 203 PRINT AT 10,16;"LOADED";AT
10,16;"LOADED"
 204 IF INKEY$="" THEN GOTO 203
 205 GOSUB 4000
 210 GOSUB 500
 220 FOR U=1 TO 5
 230 GOSUB 10
 240 GOSUB 700
 245 GOSUB 1000
 246 GOSUB 3000
 250 NEXT U
 255 GOSUB 10
 260 GOSUB 2000
 270 GOTO 210
 499 STOP
 500 DIM P(5,2)
 510 LET PJ=530
 520 LET PR=71.5
 530 LET EXP=85.7
 540 LET FL=100
 550 LET SL=100
 560 RETURN
 700 PRINT AT 0,3;" POLICY DECIS
IONS REQUIRED "
 705 LET OY=FL
 706 LET OZ=SL
 710 PRINT AT 2,0;"1 - FARE LEVE
LS"
 720 PRINT AT 3,2;"CURRENT LEVEL
 = ";INT FL;AT 4,18;" (YEAR 1=10
0)."
 730 PRINT AT 5,2;"FORCAST EFFEC
TS OF CHANGES"
 770 PRINT AT 8,5;"PASS.JOUR.";T
AB 17;"PASS.REV."
 775 LET K=INT (RND*10)-5
 780 FOR A=INT (FL-20) TO INT (F
L+20) STEP 10
 790 PRINT
 800 PRINT A;TAB 7;
 804 LET V=1
 805 LET Y=A
 806 GOSUB 1091
 810 LET EPJ=EPJ+K
 820 PRINT INT EPJ;TAB 17;
 830 LET EPR=EPR+K
```

continued on page 70

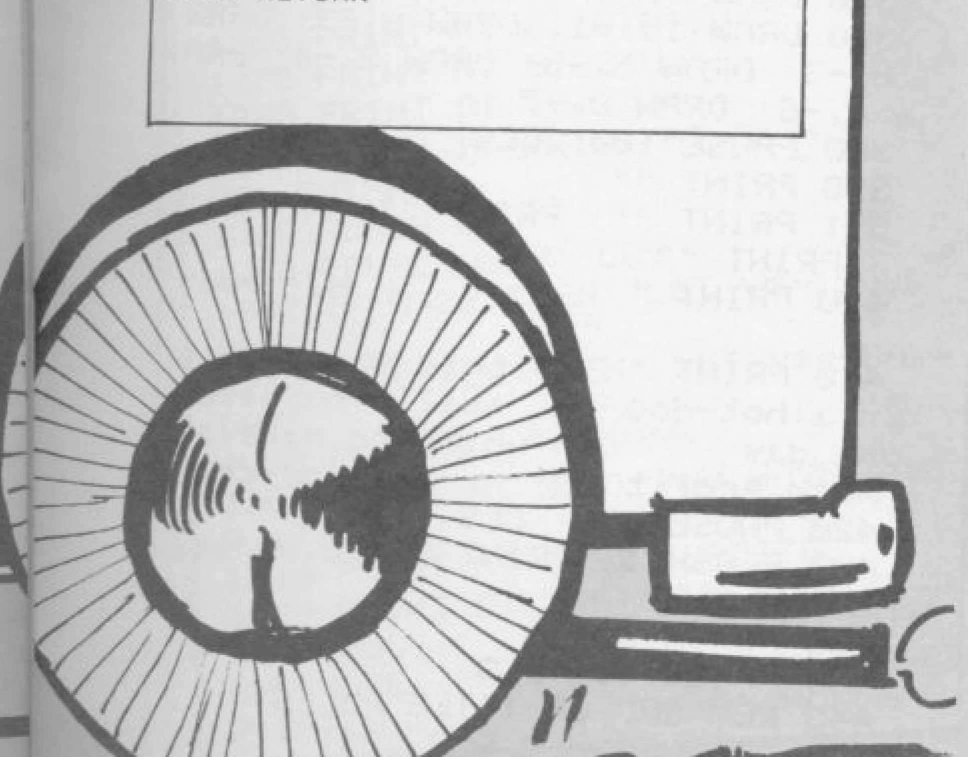
continued from page 69

```
840 PRINT INT (EPR*10)/10
850 NEXT A
860 PRINT AT 20,5;"ENTER NEW F
ARES LEVEL"
870 INPUT N
880 IF FL/N>.5 AND FL/N<2 THEN
GOTO 900
881 PRINT AT 21,0;"REJECTED BY
GOVERNMENT-TRY AGAIN"
885 GOTO 870
900 LET FL=N
910 CLS
920 PRINT AT 2,0;"2 - SERVICE L
EVELS"
930 PRINT AT 4,0;"EXISTING SERV
ICE LEVEL = ";SL
940 PRINT AT 5,19;"(YEAR 1=100)
"
950 PRINT AT 7,0;"FORCAST EFFEC
TS OF CHANGES"
951 PRINT AT 9,5;"P.JOUR.";TAB
17;"EXPEN."
952 FOR A=(SL-20) TO (SL+20) ST
EP 10
954 PRINT
955 LET V=1
956 PRINT A;TAB 7;
957 LET Y=FL
958 LET Z=A
959 GOSUB 1100
960 PRINT INT (EPJ+K);TAB 17;
962 LET EEXP=EEXP+K
964 PRINT INT EEXP
965 NEXT A
970 PRINT AT 20,0;"ENTER NEW S
ERVICE LEVELS"
972 INPUT N
974 IF N/SL<2 AND N/SL>.5 THEN
GOTO 990
976 PRINT AT 21,0;"REJECTED BY
GOVERNMENT-TRY AGAIN"
978 GOTO 972
990 LET SL=N
992 CLS
995 RETURN
1000 LET V=0
1005 GOSUB 1090
1010 LET PJ=EPJ
1020 LET PR=EPR
1030 LET EXP=EEXP
1040 LET P(U,1)=INT PJ
1050 LET P(U,2)=INT ((EXP-PR)*10
)/10
1070 RETURN
```

```
1080 LET V=0
1090 LET Y=FL
1091 LET Z=SL
1095 LET RAND=INT (RND*5)+3
1110 LET EPJ1=(PJ/4)/(Y/100)
1115 LET EPJ2=(PJ/4)*(Z/100)
1120 LET EPJ=(PJ/2+EPJ1+EPJ2)*.9
5+INT (RND*50)-25
1121 IF V=1 THEN LET EPJ=EPJ1+EP
J2
1125 IF EPJ<5 THEN LET EPJ=5
1130 LET EPR=EPJ*(Y/100)*.135
1135 IF EPR<.1 THEN LET EPR=.1
1140 LET EEXP=(EXP/2*(Z/100))+(E
XP/2)
1150 IF V<>1 THEN LET EEXP=EEXP*
(105+INT (RND*15))/100
1160 RETURN
2000 CLS
2010 PRINT AT 0,0;"PROMOTION AS
SESSMENT - PRIVATE"
2020 PRINT
2030 PRINT "PASSENGER JOURNEYS W
ERE "+("UP" AND PJ>530)+("DOWN"
AND PJ<530)+" TO ";INT PJ;" M."
2040 PRINT
2050 PRINT "GRANT REQUIREMENT "+
("ROSE" AND EXP-PR>13.8)+("FELL"
 AND EXP-PR<13.8)+" TO £";INT (E
XP-PR);"M."
2060 PRINT
2070 PRINT "FARES "+("ROSE ALARM
INGLY" AND FL>200)+("ROSE" AND F
L<=200 AND FL>100)+("FELL" AND F
L<=100)+" BY ";ABS (INT FL-100);
" P.C."
2080 PRINT
2090 PRINT
2100 PRINT "OVERALL, PERFORMANCE
 WAS ";
2110 LET K=PJ/20+(PR-EXP)+(FL/20
)
2111 IF PJ<50 THEN LET K=-5
2112 IF PR-EXP<-260 THEN LET K=-
5
2113 IF FL>500 THEN LET K=-5
2120 PRINT ("EXCELLANT" AND K>30
)+("VERY GOOD" AND K<=30 AND K>2
0)+("GOOD" AND K<=20 AND K>10)+(
"ACCEPTABLE" AND K<=10 AND K>0)+
("POOR" AND K<0)+"."
2130 PRINT AT 20,0;"     PRESS "R
" TO RE-RUN GAME     "
2140 IF INKEY$<>"R" THEN GOTO 21
40
2145 CLS
2150 RUN
3000 CLS
3010 PRINT AT 2,5;"OPTIONS AVAI
LABLE"
3020 PRINT AT 4,3;"1 - NEXT YEAR
S DECISIONS"
3030 PRINT AT 6,3;"2 - REVIEW PR
OGRESS SO FAR"
3040 PRINT AT 8,3;"3 - SAVE GAME
 AT THIS POINT"
3050 PRINT AT 10,3;"4 - INSTRUCT
IONS"
3060 LET A$=""
3070 LET A$=INKEY$
```



```
3080 IF A$="1" THEN GOTO 3300
3090 IF A$="3" THEN SAVE "BUSMAN"
3100 IF A$="4" THEN GOSUB 4000
3101 IF A$="4" THEN GOTO 3000
3110 IF A$<>"2" THEN GOTO 3010
3200 CLS
3210 PRINT "PERFORMANCE SO FAR"
3220 PRINT
3230 PRINT "YEAR";TAB 6;"PASS.J.";TAB 15;"GRANT";TAB 21;"GRANT/PASS."
3231 PRINT
3235 PRINT 1;TAB 7;530;TAB 16;14.2;TAB 22;INT ((14.2/530)*1000)/1000
3240 FOR B=1 TO U-(U=6)
3250 PRINT
3260 PRINT B+1;TAB 7;P(B,1);TAB 16;P(B,2);TAB 22;INT (P(B,2)/P(B,1)*1000)/1000
3270 NEXT B
3280 PRINT AT 20,0;"          PRESS A KEY TO CONTINUE          "
3290 PAUSE 4E4
3300 RETURN
3910 RETURN
4000 CLS
4001 PRINT AT 0,5;"B U S M A N"
4010 PRINT AT 2,0;"■ CHOOSE FARE AND SERVICE LEVELS"
4020 PRINT AT 4,0;"■ FORECAST EFFECTS DISPLAYED"
4030 PRINT AT 6,0;"■ REVIEW PROGRESS AT YEAR END"
4040 PRINT AT 8,0;"■ FIVE YEARS TO RUN THE COUNTYS"
4050 PRINT TAB 20;"BUS SYSTEM."
4060 PRINT AT 11,0;"■ PROMOTION ASSESSMENT (5 YEARS)"
4070 PRINT AT 13,0;"■ COMPETITION FROM PRIVATE CARS"
4080 PRINT AT 15,0;"■ GOVERNMENT LIMITS FLEXIBILITY"
4090 PRINT AT 18,0;"■ DECISIONS NEED TAKING NOW"
4100 PRINT AT 20,0;"  PRESS A KEY TO CONTINUE ...  "
4110 PRINT AT 20,0;"  PRESS A KEY TO CONTINUE ...  "
4120 IF INKEY$="" THEN GOTO 4100
4130 RETURN
```



SWEET SHOP

SWEETSHOP, a winner of the *Sinclair User* Christmas Competition, was written for the 1K ZX-81 by Jason Lowther of Heywood, Lancs.

You are the owner of a sweetshop and have to make a nett profit of at least £100 over five years. Using keys 1 to 4 you can decrease your prices and with keys 5 to 9 you can increase them. If you raise the prices too much you will drive away your customers.

```
  1 LET N=NOT PI
  2 LET U=CODE "▒"*CODE "▒"
  3 LET K=CODE "█"
  5 LET B=N
  6 LET E=U*U
  7 LET I=E
 10 FOR A=SGN PI TO CODE "▒"
 20 PRINT "SWEET SHOP       - YEAR ";A
 30 PRINT "INCOME = £";I
 40 PRINT "COSTS =  £";E
 50 PRINT "BALANCE £";I-E
 70 PRINT "PRICE ADJUSTMENT?"
 71 LET A$=""
 75 LET A$=INKEY$
 76 IF A$="" THEN GOTO CODE "?"*K
 77 LET J=CODE A$-CODE "4"
 78 IF J<-PI OR J>K THEN GOTO 7
 79   RAND
 80 CLS
 81 IF J=NOT PI THEN GOTO CODE "f"*CODE "■"
 82 IF RND>.2 THEN GOTO CODE ")"*K
 83 PRINT "PRICE COMPETITION REDUCES SALES"
 84 LET I=I-(I*(SGN PI/J)*(RND<J/K))
 86 LET J=INT (RND*J)+CODE "■"
 90 LET R=SGN PI+INT (RND*K)/U
 95 LET I=INT (I*(R+J/U))
120 LET E=INT (E*R)
125 LET B=B+I-E
130 NEXT A
150 PRINT ("GOOD" AND B>U)+("POOR" AND B<U)
151 PRINT "RUNNING BAL. = £";INT B
155 PAUSE 4E4
160 CLS
170 RUN
```

HOT DOGS



YOU are the owner of a hot-dog stand and have to make as much money as you can in a day. The weather forecast for that particular day is given and that gives you some idea of the amount of business you will do. Use the forecast to determine the number of hot-dogs you will purchase and the price at which you will sell them.

Written for the 16K Spectrum by D Humphries of Farnham, Surrey.

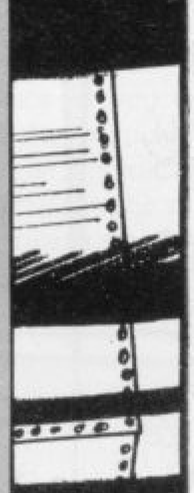
```
  1 CLS : PRINT AT 1,2;"(198) (
198) (3*198) (3*198)        (2*198
) (3*198) (3*198)"
   2 PRINT AT 2,2;"(198:sP:198:s
P:198:sP:198:2*sP:198:7*sP:198:s
P:198:sP:198:sP:198:sP:198)"
   3 PRINT AT 3,2;"(3*198:sP:198
:sP:198:2*sP:198:7*sP:198:sP:198
:sP:198:sP:198:sP:198)"
   4 PRINT AT 4,2;"(198:sP:198:s
P:198:sP:198:2*sP:198:7*sP:198:s
P:198:sP:198:sP:198:sP:198:sP:19
8)"
   5 PRINT AT 5,2;"(198:sP:198:s
P:3*198:2*sP:198:7*sP:2*198:2*sP
:3*198:sP:3*198)"
  10 DRAW 0,175: DRAW 255,0: DRA
W 0,-175: DRAW -255,0
  50 PLOT 70,40: DRAW 110,0: DRA
W 5,1: DRAW 4,4: DRAW 1,5
  60 DRAW 0,5: DRAW -127,0: DRAW
 0,-5: DRAW 1,-5: DRAW 4,-4: DRA
W 5,-1
 100 PLOT 65,65: DRAW 70,0
 110 DRAW 9,-1: DRAW 6,-3: DRAW
5,-5
 120 DRAW 5,5: DRAW 6,3: DRAW 9,
1
 130 DRAW 12,0: DRAW 1,1: DRAW -
1,1: DRAW -123,0: DRAW -1,-1: DR
AW 1,-1
 140 PLOT 67,64: DRAW 77,0
 150 DRAW 3,-1: DRAW -81,0
 160 DRAW -1,-1: DRAW 83,0
 170 DRAW 2,-1: DRAW -85,0
 180 DRAW 0,-1: DRAW 86,0
 190 DRAW 1,-1: DRAW -87,0
 200 DRAW 1,-1: DRAW 87,0
 210 DRAW 1,-1: DRAW -87,0
 220 DRAW 1,-1: DRAW 117,0
 230 DRAW 1,1: DRAW -30,0
 240 DRAW 1,1: DRAW 30,0
 250 DRAW 0,1: DRAW -29,0
 260 DRAW 1,1: DRAW 28,0
 270 DRAW 0,1: DRAW -27,0
 280 DRAW 1,1: DRAW 25,0
 290 DRAW -1,1  DRAW -21,0
 300 DRAW 6,0: DRAW 0,1: DRAW 14
,0
 310 PLOT 63,68
 320 DRAW 0,7
 330 DRAW 1,6: DRAW 3,4: DRAW 5,
5: DRAW 6,3: DRAW 9,3
 340 DRAW 15,1
 350 DRAW 47,0
 360 DRAW 15,-1: DRAW 9,-3: DRAW
 6,-3: DRAW 5,-5: DRAW 3,-4: DRA
W 1,-6: DRAW 0,-7
 380 PAUSE 100: CLS
 390 PRINT ""
 391 PRINT "": PRINT "": PRINT "
": PRINT "":
 400 PRINT "                HOT-DOGS
           "
 410 PRINT "  In this game you o
wn a hot-dog        stall.You have
one day          in-which to make as
 much Profit               as you can"
 420 PAUSE 250: CLS
 430 FLASH 1  PRINT AT 10,9;"sta
rt the day"
 435 FLASH 0
 440 PAUSE 60: CLS
 443 REM END OF TITLE PAGES
 445 REM WEATHER FOR CAST
```

```
450 GO SUB 1200
580 LET Q=25
585 GO SUB 1500
700 PAUSE 70: CLS
710 GO SUB 1600
760 GO SUB 1700
770 PAUSE 150: CLS
780 PRINT "        another go?"
790 PRINT "          (y/n)"
800 INPUT ,h$
810 IF h$="y" THEN  GO TO 1: IF
h$="n" THEN  STOP
1200 REM WEATHER FORECAST
1201 PRINT AT 2,4;"WEATHER FORE
CAST"
1202 PLOT 0,0: DRAW 255,0: DRAW
0,175: DRAW -255,0: DRAW 0,-175
1203 CIRCLE 150,40,20
1204 PLOT 130,40: DRAW -10,0: PL
OT 170,40: DRAW 10,0
1205 PLOT 150,60: DRAW 0,10: PLO
T 150,20: DRAW 0,-10
1206 PLOT 136,54: DRAW -7,7: PLO
T 164,54: DRAW 7,7: PLOT 136,26:
 DRAW -7,-7: PLOT 164,26: DRAW 7
,-7
1207 CIRCLE 144,45,3: CIRCLE 156
,45,3: PLOT 144,30: DRAW 12,0,PI
/2
1208 PLOT 110,0: DRAW -11,16,PI/
1.4: DRAW -20,15,PI/1.4: DRAW -3
5,19,PI/1.3
1218 PRINT AT 6,7;"TEMP('C)="
1219 PRINT AT 8,5;"RAIN(%CHANCE)
="
1220 PRINT AT 10,6;"SUN(%CHANCE)
="
1230 LET O=INT (RND*45)
1240 LET U=INT (RND*100)
1250 LET I=INT (RND*100)
1260 PRINT AT 6,18;O+10
1270 PRINT AT 8,22;U
1280 PRINT AT 10,22;I
1290 FLASH 1: PRINT AT 21,12;"PR
ESS ENTER"
1300 FLASH 0
1310 PAUSE 9999: CLS
1330 IF O>22 THEN  LET V$="GOOD-
DAY"
1340 IF O<=22 THEN  LET V$="BAD-
DAY"
1350 RETURN
1500 PRINT AT 3,7;"YOU HAVE";AT
3,17;Q
1510 PRINT AT 3,21;"CAPITAL"
1520 PRINT AT 5,6;"YOU HAVE SOME
 HOT DOGS           YOU CAN BUY S
OME MORE           THEY ARE `5 PE
R BATCH            OF 25,HOW MANY
 WILL              YOU BUY?"
1523 PLOT 0,0: DRAW 255,0: DRAW
0,175: DRAW -255,0: DRAW 0,-175
1524 PLOT 70,10: DRAW 100,0: DRA
W 0,20: DRAW -100,0: DRAW 0,-20:
 DRAW 0,20: DRAW 30,30: DRAW 100
,0: DRAW -30,-30: DRAW 0,-20: DR
AW 30,30: DRAW 0,20
1525 PRINT AT 19,11;"-HOTDOGS-"
1526 PLOT 85,45: DRAW 100,0
1548 INPUT ,A
1549 LET Q=Q-A*5
1550 PRINT AT 10,7;"YOU NOW HAVE
 `";AT 10,22;Q
1560 RETURN
1610 PRINT AT 3,7;"HOW MUCH WILL
 YOU                CHARGE PER HO
T DOG               (20p BREAKS-E
VEN),               (MORE THAN 60
p                   LOOSES YOUR C
USTOM)"
1611 PRINT AT 12,18;"(192:3*198:
191)";AT 13,18;"(198:92:sP:91:19
8)"
1612 PRINT AT 14,18;"(3*isP:94:1
98)"
1613 PRINT AT 15,18;"(2*isP:94:1
98:i94)"
1614 PRINT AT 16,18;"(2*sP:i98:9
2)"
1615 PRINT AT 17,18;"(2*sP:198)"
;AT 19,18;"(2*sP:198)"
1620 INPUT "p",F
1630 RETURN
1700 PAUSE 50: CLS
1710 PRINT "           HOW THE DAY W
ENT"
1720 PRINT AT 3,5;"YOU SOLD";AT
3,18;"HOTDOGS"
1730 LET X=INT (RND*100)
1731 LET X=X+30
1735 IF V$="GOOD DAY" THEN  LET
X=X+25: IF V$="BAD DAY " THEN  L
ET X=X-25
1736 IF V$="GOOD DAY" THEN  PRIN
T "     YOU HAD GOOD WEATHER": IF
 V$="BAD DAY" THEN  PRINT "
YOU HAD A BAD WEATHER"
1740 PRINT AT 3,14;X
1750 PRINT AT 5,6;"WHICH MEANS T
HAT ";AT 6,7;"YOU TOOK `"
1760 PRINT AT 6,17;F/100*X
1800 PRINT AT 8,3;"YOU MADE `"
1810 PRINT AT 8,13;X*F/100-A*5
1820 IF A*25<=X+30 THEN  LET Q=Q
+X+30*F/100-A*5
1830 IF A*25>X+30 THEN  LET Q=Q+
A*25*F/100-A*5
1840 RETURN
```

BATTLESHIP

YOU are in the fighter X1 and must land and dock with the Battleship Galastica, which is the only battleship you can reach before your fuel runs out. Your computer tells you the co-ordinates of Galastica but there are four dimensions in which it could be. Each dimension is a 4×4 grid. The co-ordinate Y, X shows you your position and after you have destroyed the aliens in your sector you may move towards the Galastica co-ordinates. Once there, if you are asked to make a move you are in the wrong dimension. To change dimension press "d" and the number of the dimension to which you wish to move. Doing this will change your co-ordinates randomly. To change sectors press the appropriate cursor key. If you want to zap the aliens in your sector the keys are "o", left; "p", right; "q", up; "d" down and to line up your sights and "m" to fire. After locating Battleship Galastica you have to land on the special pads on its wing. You approach at high speed and should use the keys "q", up; "o" left and "p" for right.

Battleship Galastica was an entry from the *Sinclair User* Christmas Competition and was written for the 48K Spectrum by Anthony Silas of London NW11.



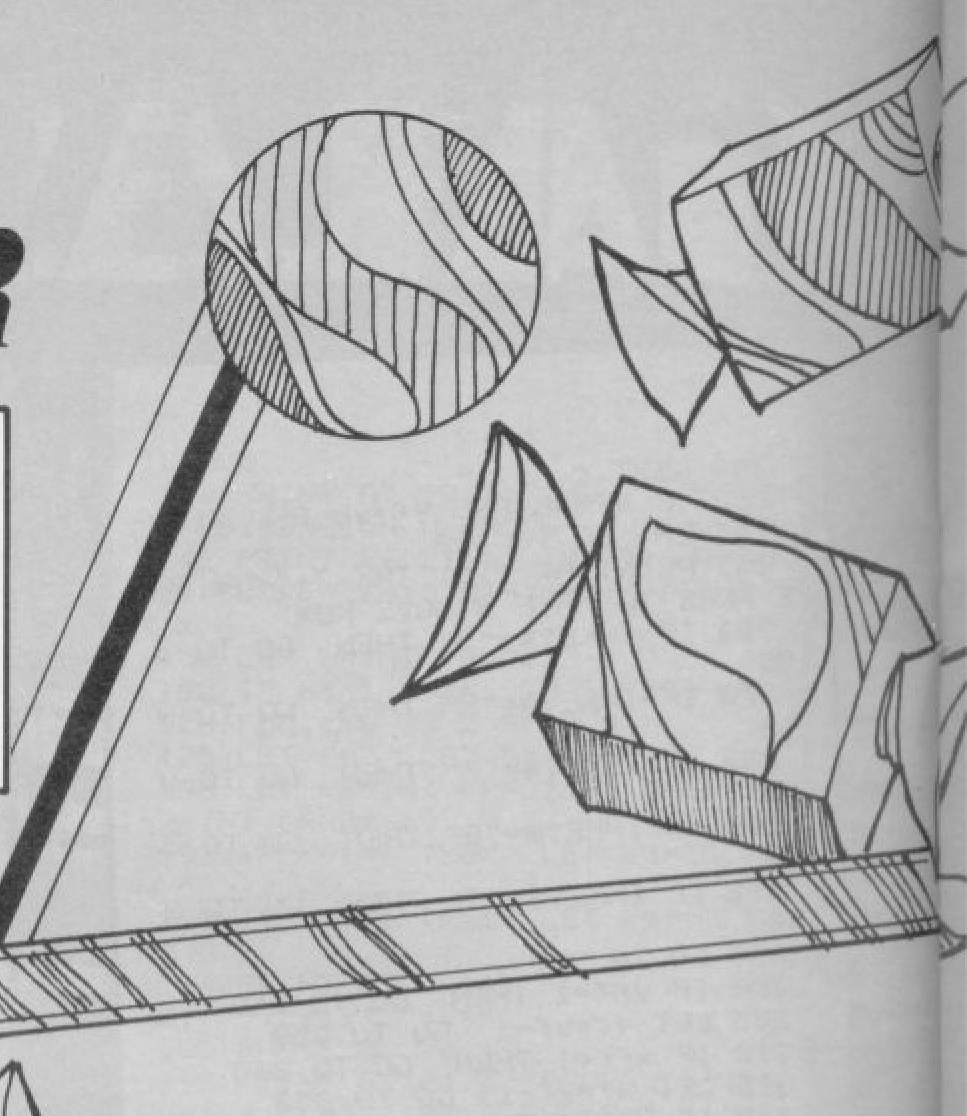


```
   1 LET hi=0
   5 LET s=0  LET p=500
  10 LET dim=1+INT (RND*4)
  20 LET di=1+INT (RND*4)
  30 LET xb=1+INT (RND*4)
  40 LET yb=1+INT (RND*4)
  50 LET xf=1+INT (RND*4)
  60 LET yf=1+INT (RND*4)
  70 IF xf=xb AND yf=yb AND dim=
di THEN  GO TO 1+INT (RND*50)
  90 PAPER 0: BORDER 1: CLS
 100 FOR a=14 TO 21 STEP 1
 102 PRINT AT a,0; INK 1;"(32*19
8)"
 104 NEXT a
 105 GO TO 110
 106 PRINT AT 1,4;"HYPERSPACE JU
MP COMPLETE"
 107 PAUSE 0
 108 PRINT AT 1,0; INK 0;"
                               "
 110 PRINT AT 15,3; PAPER 1; INK
 7;"POSITION OF FIGHTER X1 ";xf;
",";yf
 120 PRINT AT 16,10; PAPER 1; IN
K 7;"DIMENSION ";di
 130 PRINT AT 18,3; PAPER 1; INK
 7;"POSITION OF BATTLESHIP ";xb;
",";yb
 140 PRINT AT 19,7; INK 7; PAPER
 1;"DIMENSION UNKNOWN"
 142 PRINT AT 21,1; INK 7; PAPER
 1;"SCORE=";s;" HI=";hi;" POWER=
";p
 150 LET b=INT (RND*5)
 160 IF b<=1 THEN  GO TO 250
 170 FOR c=b TO 2 STEP -1
 175 LET f=7: LET g=16
 190 LET xa=INT (RND*31): LET ya
=2+INT (RND*11)
 191 IF c-1=1 THEN  LET k$="ALIE
N "
 192 IF c-1>1 THEN  LET k$="ALIE
NS "
 194 PRINT AT 1,11; FLASH 1; INK
 6;" ";c-1;" ";k$
 195 PAUSE 0
 196 PRINT AT 21,1; PAPER 1;"SCO
RE=";s;" HI=";hi;" POWER=";p;" "
 200 PRINT AT ya,xa; INK 6;"a"
 205 PRINT AT f,g; INK 0;" "
 210 LET g=g+(INKEY$="p" AND g<3
1)-(INKEY$="o" AND g>0)
 215 LET f=f+(INKEY$="a" AND f<1
3)-(INKEY$="q" AND f>2)
 220 PRINT AT f,g; INK 7;"f"
 225 IF INKEY$="m" THEN  GO SUB
241
 230 IF INT (RND*10)<>2 THEN  GO
 TO 196
 231 LET l=INT (10+40*RND)
 232 PRINT AT 1,7; INK 6;" ";l;"
 DAMAGE HIT "
 233 BEEP .1,2: BEEP .1,1: BEEP
.1,2: BEEP .1,1: BEEP .1,2: BEEP
 .1,1
 236 LET p=p-l: IF p<=0 THEN  GO
 TO 500
 239 PRINT AT 1,0; INK 0;"
                               "
 240 GO TO 196
 241 INK 7: PLOT 0,64: DRAW g*8,
(13-f)*8: PLOT 255,64: DRAW (g*8
)-255,(13-f)*8: PAUSE 10
 242 PLOT  OVER 1;0,64: DRAW  OV
ER 1;g*8,(13-f)*8: PLOT  OVER 1;
255,64: DRAW  OVER 1;(g*8)-255,(
13-f)*8
 243 BEEP .05,3: BEEP .1,2: IF f
=ya AND g=xa THEN  GO TO 245
 244 GO TO 196
 245 LET s=s+INT (20+30*RND)
 246 PRINT AT f,g; INK 0;" "
 248 PRINT AT 21,1; INK 7; PAPER
 1;"SCORE=";s;" HI=";hi;" POWER=
";p
```

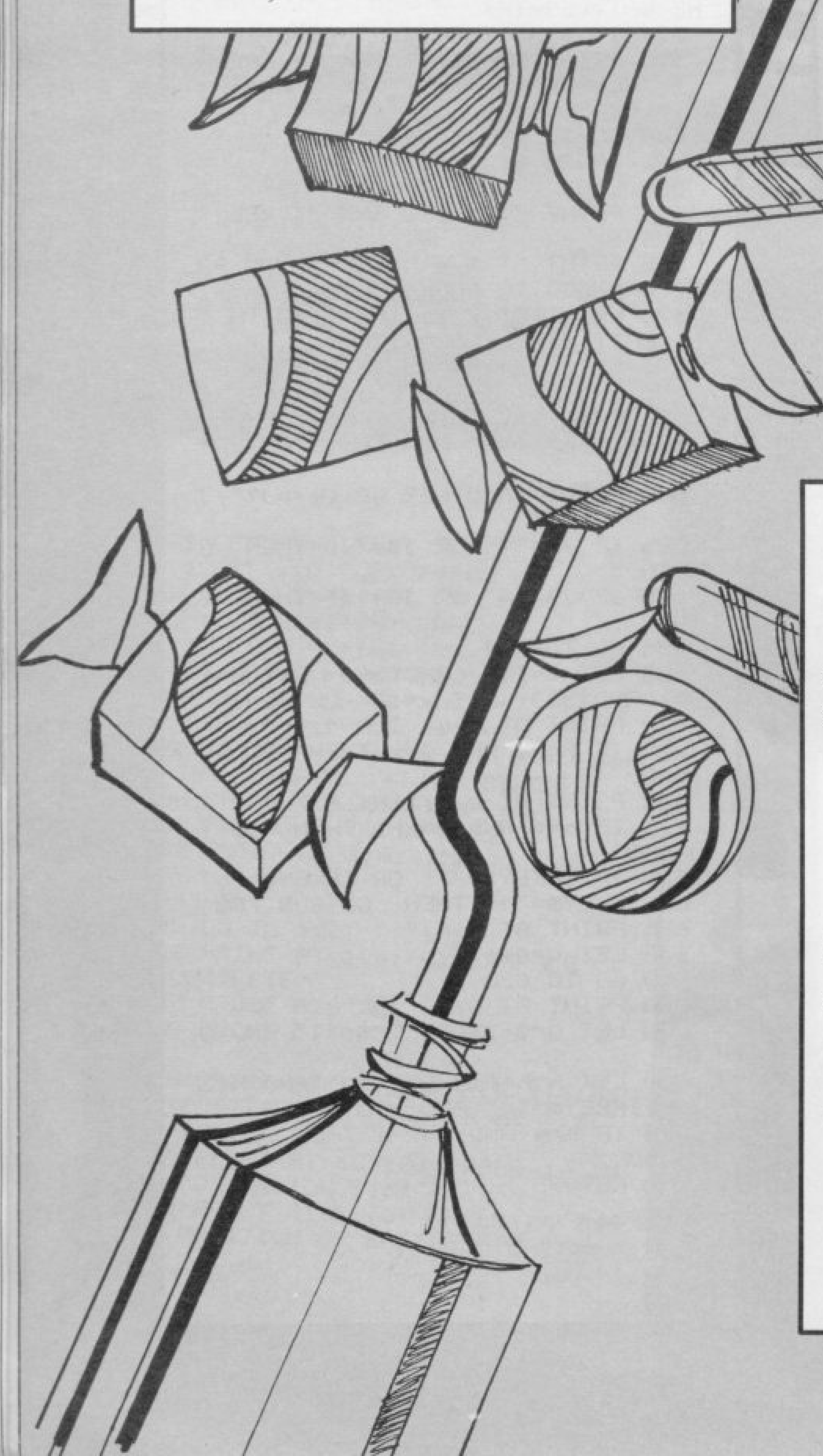
GALASTICA

```
 249 NEXT c
 250 IF xf=xb AND yf=yb AND dim=
di THEN  GO TO 400
 255 PRINT AT 1,0; INK 7;"YOU AR
E FREE TO MAKE A MOVE NOW"
 260 IF INKEY$="5" THEN  GO TO 3
00
 270 IF INKEY$="6" THEN  GO TO 3
10
 280 IF INKEY$="7" THEN  GO TO 3
20
 290 IF INKEY$="8" THEN  GO TO 3
30
 292 IF INKEY$="d" THEN  GO TO 3
40
 295 GO TO 260
 300 IF yf<=1 THEN  GO TO 260
 305 LET yf=yf-1: GO TO 350
 310 IF xf<=1 THEN  GO TO 260
 315 LET xf=xf-1: GO TO 350
 320 IF xf>=4 THEN  GO TO 260
 325 LET xf=xf+1: GO TO 350
 330 IF yf>=4 THEN  GO TO 260
 335 LET yf=yf+1: GO TO 350
 340 LET xf=1+INT (RND*4): LET y
f=1+INT (RND*4)
 341 IF INKEY$="1" THEN  LET di=
1: GO TO 350
 342 IF INKEY$="2" THEN  LET di=
2: GO TO 350
 344 IF INKEY$="3" THEN  LET di=
3: GO TO 350
 346 IF INKEY$="4" THEN  LET di=
4: GO TO 350
 348 GO TO 341
 350 PRINT AT 1,0; INK 0;"
                               "
 360 FOR n=0 TO 16
 365 PRINT AT 7,n; INK 7;".";AT
7,(31-n);"."
 370 BEEP .1,n
 380 PRINT AT 7,n; INK 0;" ";AT
7,(31-n);" "
 385 NEXT n
 390 GO TO 106
 400 PAPER 0: BORDER 1: CLS
 410 PRINT AT 1,0; INK 7;"PRESS
's' TO SWITCH TO EXTERNAL";AT 3,
10;"VIDEO CAMERA"
 420 IF INKEY$="s" THEN  GO TO 4
40
 430 GO TO 420
 440 CLS
 450 PRINT AT 19,0; INK 4;"(26*i
98:6*sP:28*i98:4*sP:17*i98)"
 460 GO TO 600
 500 PAUSE 0
 505 CLS
 510 PRINT AT 3,12; INK 7;"UNLUC
KY"
 520 IF p<=0 THEN  PRINT AT 5,5;
 INK 7;"YOU RAN OUT OF POWER": G
O TO 524
 522 PRINT AT 5,6; INK 7;"YOU FA
ILED TO DOCK "
 523 PRINT AT 7,6; INK 7;"WITH T
HE BATTLESHIP"
 524 IF s>hi THEN  LET hi=s
 525 PRINT AT 21,1; INK 7; PAPER
 1;"SCORE=";s;" HI=";hi;" POWER=
";p
 540 GO TO 580
 550 PAUSE 0
 555 CLS
 560 PRINT AT 3,11; INK 7;"WELL
DONE!"
 565 PRINT AT 5,4; INK 7;"YOU HA
VE MANAGED TO DOCK"
 570 PRINT AT 7,1; INK 7;"WITH T
HE BATTLESHIP GALASTICA"
 572 LET s=s+INT (50+50*RND)
 573 IF s>hi THEN  LET hi=s
 575 PRINT AT 21,1; INK 7; PAPER
 1;"SCORE=";s;" HI=";hi;" POWER=
";p
 580 INPUT "ANOTHER GO (y/n)?";j
$
 585 IF j$="Y" OR j$="y" THEN  G
O TO 5
 590 IF j$="N" OR j$="n" THEN  S
TOP
 595 GO TO 580
 600 LET y=INT (RND*26): LET h=I
NT (RND*32): LET x=18: LET g=1
 610 PRINT AT x,y; INK 4;"h"
 620 IF h<>y AND g=x THEN  GO TO
 500
 622 PRINT AT g,h; INK 6;"u"
 625 IF h=y AND g=x-1 THEN  GO T
O 550
 630 IF INKEY$="p" OR INKEY$="o"
 OR INKEY$="q" THEN  GO SUB 700
 635 PRINT AT g,h;" "
 640 LET g=g+1
 650 GO TO 620
 700 PRINT AT g,h; INK 0;" "
 710 LET g=g-2*(INKEY$="q" AND g
>0)
 720 LET h=h+(INKEY$="p" AND h<3
1)-(INKEY$="o" AND h>0)
 725 IF h=y AND g=x-1 THEN  GO T
O 550
 730 RETURN
```

PLAQUE DESTROYER



YOU CONTROL the toothpaste tube and must destroy the sweets as they approach from the opposite side of the screen to prevent them forming a layer of anti-fluoride germs. Every 13 seconds the tube moves one space nearer the end of the screen. Fire with "0" and use keys "6" and "7" to move up and down. **Plaque Destroyer** was written for the 16K ZX-81 by Laurence Willis of Tamworth, Staffs.



```
   1 GOSUB 2000
   3 LET Z$=">0< "
   4 LET SC=0
   5 LET POS=1
   6 LET HLOZ=1
   7 CLS
   8 PRINT AT 0,0;"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
   9 PRINT AT 21,0;"▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒"
  10 LET A$=" ■▒▒▒▒▒▒▒▒▒■ "
  11 GOSUB 3000
  15 LET B$="             "
  20 LET C$=" ■▒COLC▒▒▒■ "
  30 LET A=9
  35 LET R=INT (RND*16)+2
  36 LET B=28
  37 PRINT AT R,B;Z$
  40 PRINT AT A,HLOZ;A$;AT A+1,H
LOZ;C$;AT A-1,HLOZ;B$;AT A+2,HLO
Z;B$
  50 LET A=A+(INKEY$="6" AND A<1
8)-(INKEY$="7" AND A>2)
  51 IF INKEY$="0" THEN GOTO 70
  52 IF POS/13=INT (POS/13) THEN
 GOSUB 200
  53 IF (A=R OR A+1=R) AND HLOZ+
11=B THEN GOTO 998
  54 IF HLOZ+12>=31 THEN GOTO 6
  56 IF B=0 THEN PRINT AT R,B;"
"
  57 IF B=0 THEN GOTO 35
  58 LET B=B-1
  59 LET POS=POS+1
  60 GOTO 37
  70 IF LEN A$>=B THEN GOTO 37
```



```
  75 FOR C=HLOZ+12 TO B
  80 PRINT AT A+1,C;" -("
  90 NEXT C
 100 PRINT AT A+1,C;"    "
 110 IF A+1=R THEN LET SC=SC+1
 120 IF A+1=R THEN GOTO 35
 130 GOTO 37
 200 LET HLOZ=HLOZ+1
 240 RETURN
 250 SAVE "PLAQUE DESTROYER"
 260 GOTO 1
 998 PRINT AT 1,0;"           SCORE=";
SC;"            "
 999 PRINT AT 20,0;"-------------
-------------------"
1000 PRINT AT A,HLOZ;"
";AT A+1,HLOZ;"           ";AT
A,HLOZ;"          ";AT A+1,HLOZ
;"          "
1010 IF INKEY$="" THEN GOTO 1000

1020 CLS
1030 GOTO 0
2000 FAST
2005 PRINT "



                    FLURIDE PROTEC
TION



"
2010 PRINT "





"
2020 FOR A=12 TO 21
2030 PRINT "

"
2040 NEXT A
2050 PRINT AT 13,5;"THE NEW IMPR
OVED  GAME.            "
2060 PRINT "        WITH ADDED FLOU
RIDE AND,           "
2070 PRINT "        PLAQUE DESTROYE
R.                  "
2080 PRINT AT 21,0;"PRESS A KEY
TO CONTINUE........."
2085 SLOW
2090 IF INKEY$="" THEN GOTO 2080

2100 CLS
2110 PRINT AT 0,7;"PLAQUE DESTRO
YER."
2120 PRINT "YOU (THE TUBE OF TOO
THPASTE)        MUST SHOOT DOWN THE
 SWEETS         SO THEY DO NOT FORM
 A LAYER        OF ANTI-FLORIDE GER
MS."
2130 PRINT "YOU MOVE DOWN WITH K
EY """6"""          AND UP WITH KEY "
"7"""               FOR EVERY 13 SEC
ONDS YOU WILL    MOVE FORWARD ONE
 SPACE UNTIL YOUREACH THE END OF
 THE SCREEN.              GOOD LUCK.
......."
2140 PRINT "PRESS "0" TO FIRE
            PRESS A KEY TO START
 "
2150 IF INKEY$="" THEN GOTO 2150

2160 CLS
2170 RETURN
3000 LET B$="   FLORIDE  LAYER
 "
3010 FOR A=1 TO LEN B$
3020 PRINT AT A,0;B$(A TO A)
3030 NEXT A
3040 RETURN
```

ANAGRAM



THE COMPUTER will display a six-letter word which you must decipher. Work out the answer and you will then be told if you are correct. You can alter the words in the program by LISTing line 20 and replacing the current words with some different six letter words. **Anagram** was written for the 1K ZX-81 by Paul Azzopardi, London E2.

```
   5 PRINT "ANAGRAM"
  10 DIM C$(VAL "6")
  20 LET A$="CRUMBSREVIEWPARROTP
ENCILSCHOOLRECORDORANGEPUZZLEHEI
GHTBUTTER"
  30 LET A=LEN A$/VAL "6"
  40 LET B=INT (RND*A)*VAL "6"
  50 LET B$=A$(B+VAL "1" TO B+VA
L "6")
  60 LET J=LEN B$
  70 FOR X=SGN PI TO J
  80 LET C$(X)=B$(X)
  90 NEXT X
 100 FOR X=SGN PI TO J
 110 LET W=INT (RND*J)+SGN PI
 120 LET V=INT (RND*J)+SGN PI
 130 LET T$=C$(W)
 140 LET C$(W)=C$(V)
 150 LET C$(V)=T$
 160 NEXT X
 170 FOR X=SGN PI TO J
 180 PRINT C$(X);
 190 NEXT X
 195 PRINT
 200 PRINT "ENTER GUESS?"
 210 INPUT U$
 215 PRINT
 220 IF U$=B$ THEN PRINT "CORREC
T"
 230 IF U$<>B$ THEN PRINT "WRONG
,THE CORRECT ANSWER IS ";B$
 240 PAUSE 4E4
 250 CLS
 260 GOTO 40
```

MOUNT TRIO



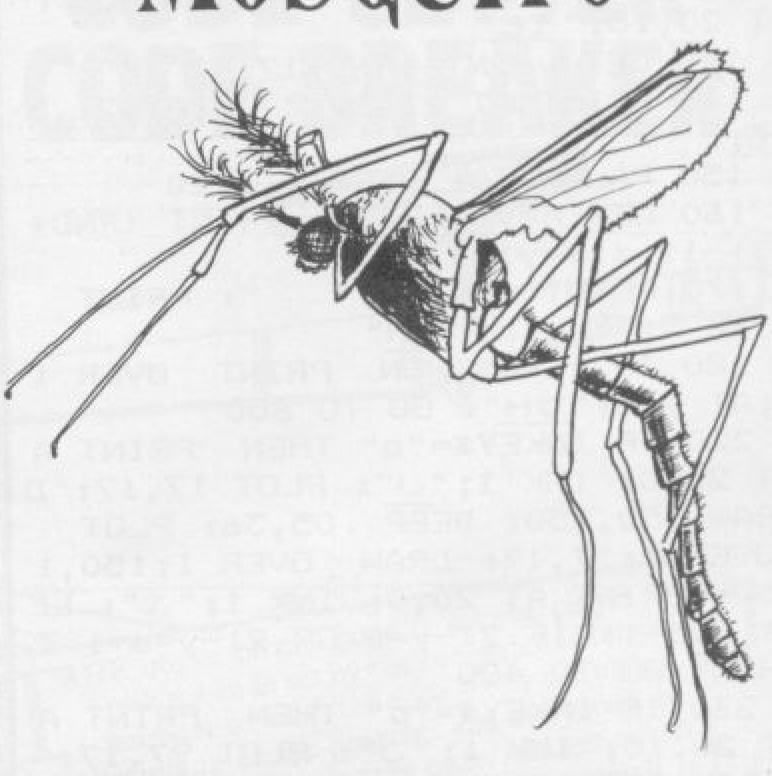
CLIMB THE MOUNTAIN from your base camp without crashing or falling. If you remain on the path you should have a safer journey. There are various scoring points along the way, the highest score being at the summit of the windswept middle peak. **Mount Trio** was written for the 16K ZX-81 by T Stuttard of Gorton, Manchester.

```
  10 REM MOUNT TRIO
  20 CLS
  30 GOSUB 198
  40 LET T=0
  50 LET S=0
  60 LET SC=100
 120 LET X=19
 130 LET Y=25
 135 PRINT AT X,Y;" "
 140 IF INKEY$="5" THEN LET Y=Y-1
 142 IF INKEY$="6" THEN LET X=X+1
 144 IF INKEY$="7" THEN LET X=X-1
 146 IF INKEY$="8" THEN LET Y=Y+1
 150 PRINT AT X,Y;
 160 IF PEEK (PEEK 16398+256*PEEK 16399)=CODE "(9f)" THEN GOTO 500
 170 IF PEEK (PEEK 16398+256*PEEK 16399)=CODE "(i9)" THEN GOTO 1000
 180 IF PEEK (PEEK 16398+256*PEEK 16399)=CODE "(ir)" THEN GOTO 1006
 190 IF PEEK (PEEK 16398+256*PEEK 16399)=CODE "(9e)" THEN GOTO 2000
 192 IF PEEK (PEEK 16398+256*PEEK 16399)=CODE "(99)" THEN GOTO 250
 195 PRINT AT X,Y;"(ia)"
 196 GOTO 135
 198 FAST
 200 FOR N=29 TO 1 STEP -1
 205 PRINT AT 21-N,N;"(9e)";AT 15-N,N;"(9e)";AT 10-N,N;"(9e)";AT 21,N;"(9e)"
 210 NEXT N
 215 PRINT AT 10,25;"(i9)";AT 10,5;"(ir)";AT 12,22;"(i9)";AT 4,25;"(ir)";AT 3,7;"(ir)";AT 10,11;"(i9)";AT 15,25;"(9r)";AT 21,29;"(9e)";AT 20,29;"(9e)"
 218 PRINT AT 7,22;"(9r)";AT 6,27;"(9r)";AT 6,4;"(9w)";AT 7,8;"(9w)";AT 15,6;"(9w)";AT 20,12;"BASE CAMP";AT 19,10;"(9e:9r)";AT 19,15;"(9e:9r)";AT 19,21;"(9e:9r)";AT 17,13;"(9e:9r)";AT 17,18;"(9e:9r)";AT 0,10;"(9f)";AT 0,21;"(9f)";AT 0,15;"(99)";AT 0,1;"MOUNT";AT 0,27;"TRIO"
 220 PRINT AT 2,17;"(9r)";AT 4,17;"(9r)";AT 4,14;"(9r)"
 230 SLOW
 240 RETURN
 244 INPUT A$
 248 IF A$<>"" THEN GOTO 3000
 250 CLS
 260 LET S=S+SC+1000
 270 GOTO 1025
 500 CLS
 510 LET S=S+SC+100
 550 GOTO 1008
1000 CLS
```

MOUNT TRIO

```
1001 LET S=S+SC+20
1002 GOTO 1012
1006 LET SC=SC+80
1007 CLS
1008 LET S=S+SC
1012 PRINT AT 10,10;"SCORE=";S
1020 PRINT AT 11,3;"       PRESS N
EWLINE"
1022 INPUT A$
1023 GOTO 0
1025 PRINT AT 10,10;"TOP SCORE="
;S
1030 INPUT A$
1035 GOTO 0
1060 REM CRASHED
2000 CLS
2010 PRINT AT 10,10;"THE END"
2030 PRINT AT 11,8;"YOU CRASHED"
2040 PRINT AT 12,0;"INPUT I FOR
INSRUCTIONS OR            NEWLINE
 TO PLAY"
2042 INPUT A$
2044 IF A$<>"" THEN GOTO 2080
2050 INPUT A$
2060 GOTO 0
2080 CLS
3000 PRINT "INSRUCTIONS, THE OBJ
ECT IS TO
          CLIMB THE MOUNTAIN W
ITHOUT
          CRASHING, USING THE
USUAL
          CURSERS KEYS "
3010 PRINT "KEEP TO THE PATHS OR
 YOU WILL
          CRASH, THERE ARE WAY
S OVER THE
          CLIFFS IF YOU CAN FI
ND THEM
          ALSO VARIOUS SCORING
 POINTS
          ON THE WAY UP,
"
3020 PRINT "THE TOP SCORE BEING
THE MIDDLE
          PEAK,BUT IT IS VERY
WINDY UP
          THERE, MIND HOW YOU
 GO, NEWLINE"
3030 INPUT A$
3040 GOTO 10
```

MOSQUITO



YOU HAVE two spray guns and you must wipe out an invasion of giant mosquitoes from an old Japanese movie. The mosquitoes attack in squads of 20 and you have 50 squirts with which to kill them. If you are unsuccessful and run out of spray the mosquito larvae will then attack in a flying saucer. Use "q" for the left spray and "p" for the right. **Mosquito** was written for the 16K Spectrum by Sam French of Saudi Arabia.

```
  10 PRINT AT 0,11;"MOSQUITOS"''
"You have two spray guns to shoo
tdown an invasion of giant
 mosquitos left over from an old
 Japanese movie."''
  20 PRINT "The left spray is fi
red by key  ""q"", the right by
key ""p""."''
  30 PRINT "The mosquitos attack
 in squads  of 20. You have only
 50 squirts to get them."'''"If y
ou run out of spray, their  larv
ae will attack in a flying  sauc
er salvaged from an old     Japa
nese video game."''
  40 PRINT "Rotsa ruck."''
  50 PRINT "Press any key to sta
rt."
  60 IF INKEY$="" THEN  GO TO 60
  70 CLS : GO SUB 1000
  80 BORDER 2: PAPER 5: INK 0: C
LS
  90 LET b=0: LET s=0: LET c=50
 100 LET e=29
 120 PRINT  INK 1;AT 21,0;"(2*ig
8:8*ig3:2*ig8:18*ig3)";c
```

continued on page 80

continued from page 79

```
 130 PRINT  INK 1;AT 20,0;"IE";A
T 20,10;"IE"
 140 LET y=INT (RND*17)+2
 145 PRINT AT 21,30;"  ";AT 21,3
0;c
 150 PAUSE 30: BEEP 0.1,20
 160 LET n=y: LET y=y+(INT (RND*
3)-1)-(19=y)+(1=y)
 170 PRINT AT n,e;"   ": PRINT
INK 2;AT y,e;"GH"
 180 IF c<=0 THEN  PRINT  OVER 1
;AT y,e;"GH": GO TO 600
 220 IF INKEY$="q" THEN  PRINT A
T 20,0; INK 1;"J": PLOT 17,17: D
RAW 150,150: BEEP .05,36: PLOT
OVER 1;17,17: DRAW  OVER 1;150,1
50: PRINT AT 20,0; INK 1;"I": LE
T c=c-1: IF 21-y=e OR 21-y=e+1 T
HEN  GO TO 400
 230 IF INKEY$="p" THEN  PRINT A
T 20,10; INK 1;"J": PLOT 97,17:
DRAW 150,150: BEEP .05,36: PLOT
 OVER 1;97,17: DRAW  OVER 1;150,
150: PRINT AT 20,10; INK 1;"I":
LET c=c-1: IF 31-y=e OR 31-y=e+1
 THEN  GO TO 400
 240 BEEP .015,-12
 250 IF e=0 THEN  PRINT AT y,e;"
  ": GO TO 410
 260 LET e=e-INT (RND*2)
 280 GO TO 160
 400 LET s=s+1:  PRINT  INK 0;AT
 y,e-1;"CDCD": BEEP 0.3,-25: PA
USE 20: PRINT AT y,e-1;"      "
 410 LET b=b+1: LET e=29
 420 IF b>19 THEN  CLS : GO TO 4
40
 430 GO TO 140
 440 PRINT AT 6,11;"Game Over"
 450 PRINT AT 8,11;"Score=";s;AT
 10,8;50-c;" squirts used";AT 21
,2;"Press any key for a new game
"
 460 IF s=18 OR s=19 THEN  PRINT
 AT 15,6;"Not bad for a klutz."
 470 IF s=20 THEN  PRINT AT 15,2
;"So awright awready you can
  beat a machine. Big deal."
 480 IF S<6 THEN  PRINT AT 15,2;
"Ya dumb nurd. You can't even
 outwit a machine."
 490 FOR f=-10 TO 10:  BEEP 0.1,
f:  BORDER RND*7: NEXT f:  BEEP
2,-17: BORDER 7
 500 IF INKEY$="" THEN  GO TO 50
0
 510 PAUSE 120: GO TO 80
 600 LET e=29: PRINT AT 21,17;"
OUT OF SPRAY!!"
 610 LET e=e-1
 620 PRINT  INK 2;AT 18,e;"AB ":
FOR i=1 TO 6: BEEP .015,-12: PA
USE 2: NEXT i
 630 IF e=22 THEN  PLOT 184,25:
DRAW -108,-20: PAUSE 3: PLOT  OV
ER 1;184,25: DRAW  OVER 1;-108,-
20
 640 IF e=21 THEN  PRINT ;AT 20,
9;"FDCF";AT 19,9;"FCDF";AT 21,
10;"FF"
 643 BEEP .015,-12
 645 IF e=21 THEN  FOR i=1 TO 20
: BEEP .01,i/4: BORDER INT (i/3)
: NEXT i
 650 IF e=12 THEN  PLOT 104,25:
DRAW -104,-20: PAUSE 3: PLOT  OV
ER 1;104,25: DRAW  OVER 1;-104,-
20
 660 IF e=11 THEN  PRINT AT 20,0
;"DCF";AT19,0;"DF";AT 21,0;"CF"
 665 IF e=11 THEN  FOR i=1 TO 20
: BEEP .01,i/4: BORDER INT (i/3)
: NEXT i
 670 IF e=6  THEN  CLS : PRINT A
T 2,2;"You lose. The good guys w
in.": GO TO 440
 680 GO TO 610
1000 FOR f=0 TO 7: READ cg: POKE
 USR "A"+f,cg: NEXT f
1010 FOR f=0 TO 7: READ cg: POKE
 USR "B"+f,cg: NEXT f
1020 FOR f=0 TO 7: READ cg: POKE
 USR "C"+f,cg: NEXT f
1030 FOR f=0 TO 7: READ cg: POKE
 USR "D"+f,cg: NEXT f
1040 FOR f=0 TO 7: READ cg: POKE
 USR "E"+f,cg: NEXT f
1050 FOR f=0 TO 7: READ cg: POKE
 USR "F"+f,cg: NEXT f
1060 FOR f=0 TO 7: READ cg: POKE
 USR "G"+f,cg: NEXT f
1070 FOR f=0 TO 7: READ cg: POKE
 USR "H"+f,cg: NEXT f
1075 FOR f=0 TO 7: READ cg: POKE
 USR "I"+f,cg: NEXT f
1080 FOR f=0 TO 7: READ cg: POKE
 USR "J"+f,cg: NEXT f
1090 DATA 0,0,15,63,127,255,255,
3,0,0,240,252,254,255,255,192
2000 DATA 130,16,0,66,0,36,0,72,
65,8,0,66,0,36,0,18
2010 DATA 3,7,14,60,248,248,240,
240,0,32,0,4,64,0,16,0
2020 DATA 128,32,12,30,255,6,0,1
,0,0,60,126,255,124,0,64
2030 RETURN
2040 DATA 255,255,255,24,24,24,2
4,24,0,0,0,0,255,255,255,24
```

CODE SETTER-CODE BREAKER



THE object of the game is for the player to break the code set by the computer or for the computer to break the code set by the player. At the beginning of the program you are given the option of breaking or setting the code. A direct match is indicated by the "★" and an indirect match is indicated by an "o".

If at any point the program goes into the Command Mode, due to your using the BREAK key or on completion of a game, do not use CLEAR or RUN but ENTER GOTO 10.

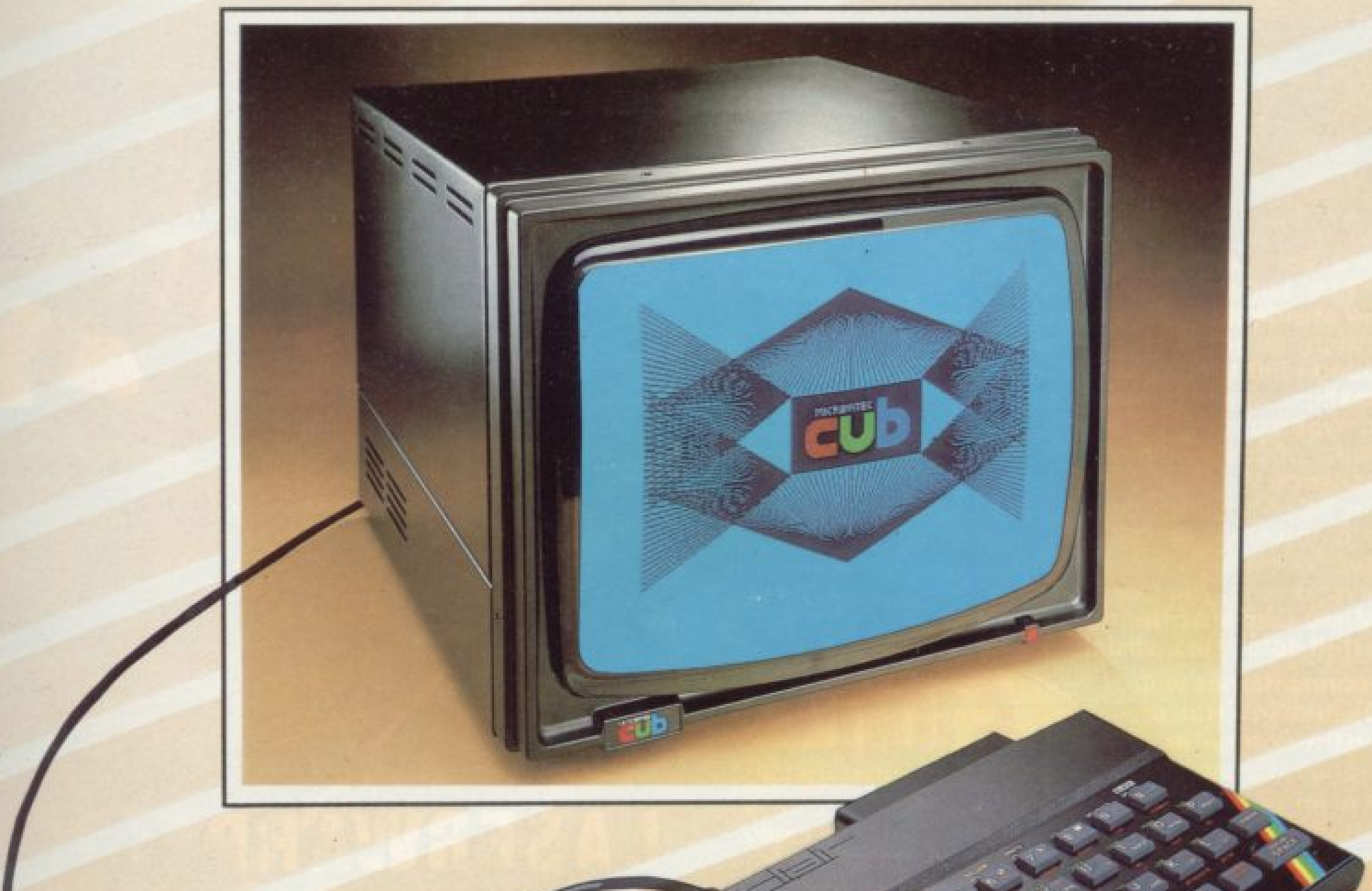
Code Setter—Code Breaker is one of the entries from the Sinclair User Christmas Competition and was written for the 48K Spectrum by F W Manders of Lincoln.

```
  10 CLS : PRINT "  CODE SETTER
 - CODEBREAKER"
  20 PRINT AT 4,0;"  Can you fin
d the 4-digit code quicker than
the Spectrum?"
  25 PRINT AT 8,0;"Press ""m"" t
o go first"''"Press ""c"" for co
mputer first"
  30 LET gms=0: LET gs=0: LET yo
u=0: LET me=0
  35 PAUSE 0
  40 IF INKEY$="m" THEN  GO TO 1
00
  50 IF INKEY$="c" THEN  GO TO 9
00
  60 GO TO 35
 100 LET gs=gs+1: CLS : FOR f=1
TO 10: PRINT AT 2*f,8;
 105 PRINT  PAPER 5;" ";
 110 IF f<10 THEN  PRINT  PAPER
6;" ";
 120 PRINT  PAPER 6;f;" ++++ :::
: "; PAPER 5;" ": NEXT f
 130 PRINT  PAPER 5; INK 6;AT 1,
8;" "; INVERSE 1;"(13*93)"; INVE
RSE 0;" "
 140 PRINT  PAPER 5; INK 6;AT 21
,8;" (13*93) "
 150 FOR f=3 TO 19 STEP 2
 160 PRINT  PAPER 5;AT f,8;" ";
PAPER 6;"              "; PAPER 5
;" "
 170 NEXT f
 180 PRINT AT 0,10;"CODE SETTER"
 190 PRINT AT 2,2;"YOU";AT 2,27;
"ME";AT 4,0;"Goes ";gs;AT 4,25;"
Goes ";gms;AT 6,0;"Scr. ";you;AT
 6,25;"Scr. ";me
 200 DIM a$(3,4)
 210 FOR f=1 TO 4: LET a$(1,f)=S
TR$ (INT (RND*6)+1): NEXT f
 220 FOR f=1 TO 10: LET a$(2)=a$
(1)
 225 LET a=0
 230 BEEP .25,1: INPUT "I await
your entry";a$(3)
 232 IF a$(3)="Q   " THEN  GO TO
 4000
 240 PRINT  PAPER 6;AT 2*f,12;a$
(3)
 250 FOR g=1 TO 4
 260 IF a$(2,g)<>a$(3,g) THEN  G
O TO 280
 270 LET a=a+1: LET a$(2,g)="|":
 LET a$(3,g)="@"
 275 PRINT  PAPER 6;AT 2*f,16+a;
"*"
 280 NEXT g
 290 IF a=4 THEN  LET you=you+f:
 GO TO 360
 300 FOR g=1 TO 4: FOR h=1 TO 4
 310 IF a$(2,g)<>a$(3,h) THEN  G
O TO 340
 320 LET a=a+1: LET a$(2,g)="|":
 LET a$(3,h)="@"
 330 PRINT  PAPER 6;AT 2*f,16+a;
"o"
 340 NEXT h: NEXT g: NEXT f
 350 PRINT AT 0,10;"  ";a$(2);"
      "
 355 LET you=you+f
 360 BEEP .25,24: PRINT AT 6,5;y
ou: INPUT "Press ENTER to contin
ue";p$
 365 IF gs+gms=10 THEN  GO TO 40
00
 370 GO TO 900
 900 LET gms=gms+1: LET rr=1296:
 CLS : FOR f=1 TO 10: PRINT AT 2
2-2*f,8;
 910 LET ff=11-f
 920 PRINT  PAPER 5;" "; PAPER 6
;" :::: ++++ "; INK 3;ff;
 930 IF ff<10 THEN  PRINT  PAPER
```

```
6;" ";
 935 PRINT  PAPER 5;" "
 940 NEXT f
 945 PRINT  PAPER 5; INK 6;AT 1,
8;" "; INVERSE 1;"(13*93)"; INVE
RSE 0;" "
 950 PRINT  PAPER 5; INK 6;AT 21
,8;" (13*93) "
 960 FOR f=3 TO 19 STEP 2
 970 PRINT  PAPER 5;AT f,8;" ";
PAPER 6;"              "; PAPER 5
;" "
 980 NEXT f
 990 PRINT AT 0,10;"CODEBREAKER"
 995 PRINT AT 2,2;"YOU";AT 2,27;
"ME";AT 4,0;"Goes ";gs;AT 4,25;"
Goes ";gms;AT 6,0;"Scr. ";you;AT
 6,25;"Scr. ";me
1000 DIM m$(4): DIM w$(4): DIM z
$(10,4): DIM z(10,2)
1005 LET w=1: LET v=0
1010 FOR f=1 TO 10
1013 IF w$<>"    " THEN  GO TO 2
500
1015 LET v=v+1: IF v>1296 THEN
GO TO 3000
1020 LET r=INT (RND*rr)+1
1025 LET z$(f, )=x$(r)
1030 LET x$(r)=x$(rr): LET x$(rr
)=z$(f)
1035 LET rr=rr-1
1040 IF f>1 THEN  FOR g=1 TO f-1
: IF z$(f)=z$(g) THEN  GO TO 101
3
1050 NEXT g: IF f>1 THEN  GO SUB
 2300
1060 PRINT  PAPER 6; INK 1;AT 2*
f,15;z$(f)
1065 PRINT  PAPER 6; FLASH 1;AT
2*f,10;"::::"
1070 BEEP .25,12: INPUT "Please
mark using * & o ";m$
1072 IF m$="Q   " THEN  GO TO 40
00
1080 FOR g=1 TO 4: IF m$(g)=" "
THEN  LET m$(g)=":"
1090 IF m$(g)="*" THEN  LET z(f,
1)=z(f,1)+1
1100 IF m$(g)="o" THEN  LET z(f,
2)=z(f,2)+1
1110 NEXT g: PRINT  PAPER 6;AT 2
*f,10;m$
1130 IF z(f,1)=4 THEN  LET me=me
+f: GO TO 3050
1140 IF z(f,1)+z(f,2)=4 THEN  LE
T w$=z$(f)
1210 NEXT f
2300 DIM y$(10,2,4): DIM y(10):
FOR g=f-1 TO 1 STEP -1
2305 PRINT  PAPER 6; INK 1;AT 2*
f,15;z$(f)
2310 LET y$(g,1)=z$(g): LET y$(g
,2)=z$(f)
2320 FOR h=1 TO 4: IF y$(g,1,h)<
>y$(g,2,h) THEN  GO TO 2340
2330 LET y(g)=y(g)+10: LET y$(g,
1,h)="|": LET y$(g,2,h)="@"
2340 NEXT h: IF y(g)<>z(g,1)*10
THEN  GO TO 1013
2345 NEXT g
2350 FOR g=f-1 TO 1 STEP -1
2355 FOR h=1 TO 4: FOR j=1 TO 4
2360 IF y$(g,1,h)<>y$(g,2,j) THE
N  GO TO 2380
2370 LET y(g)=y(g)+1: LET y$(g,1
,h)="|": LET y$(g,2,j)="@"
2380 NEXT j: NEXT h
2390 IF y(g)<>(z(g,1)*10+z(g,2))
 THEN  GO TO 1013
2400 NEXT g: RETURN
2500 IF w>24 THEN  GO TO 3000
2505 FOR g=1 TO 4
2510 LET z$(f,g)=w$(VAL u$(w,g))
2520 NEXT g: LET w=w+1
2530 GO TO 1040
3000 INPUT "Wrong marking. Press
 ENTER";p$
3010 IF p$<>"" THEN  GO TO 3000
3020 GO TO 900
3050 PRINT AT 6,30;me: BEEP .25,
24: INPUT "Press ENTER to contin
ue";p$
3055 IF p$="Q" THEN  GO TO 4000
3060 IF gs+gms=10 THEN  GO TO 40
00
3070 GO TO 100
4000 PRINT AT 10,0;"<><><><><><>
<><><><><><><><><><>";AT 11,0;">
                              <"
4010 PRINT AT 12,0;">To Start Ag
ain<>Enter GO TO 10<"
4020 PRINT AT 13,0;">
                              <";AT 14,0;"<
><><><><><><><><><><><><><><><>"
4030 STOP
```



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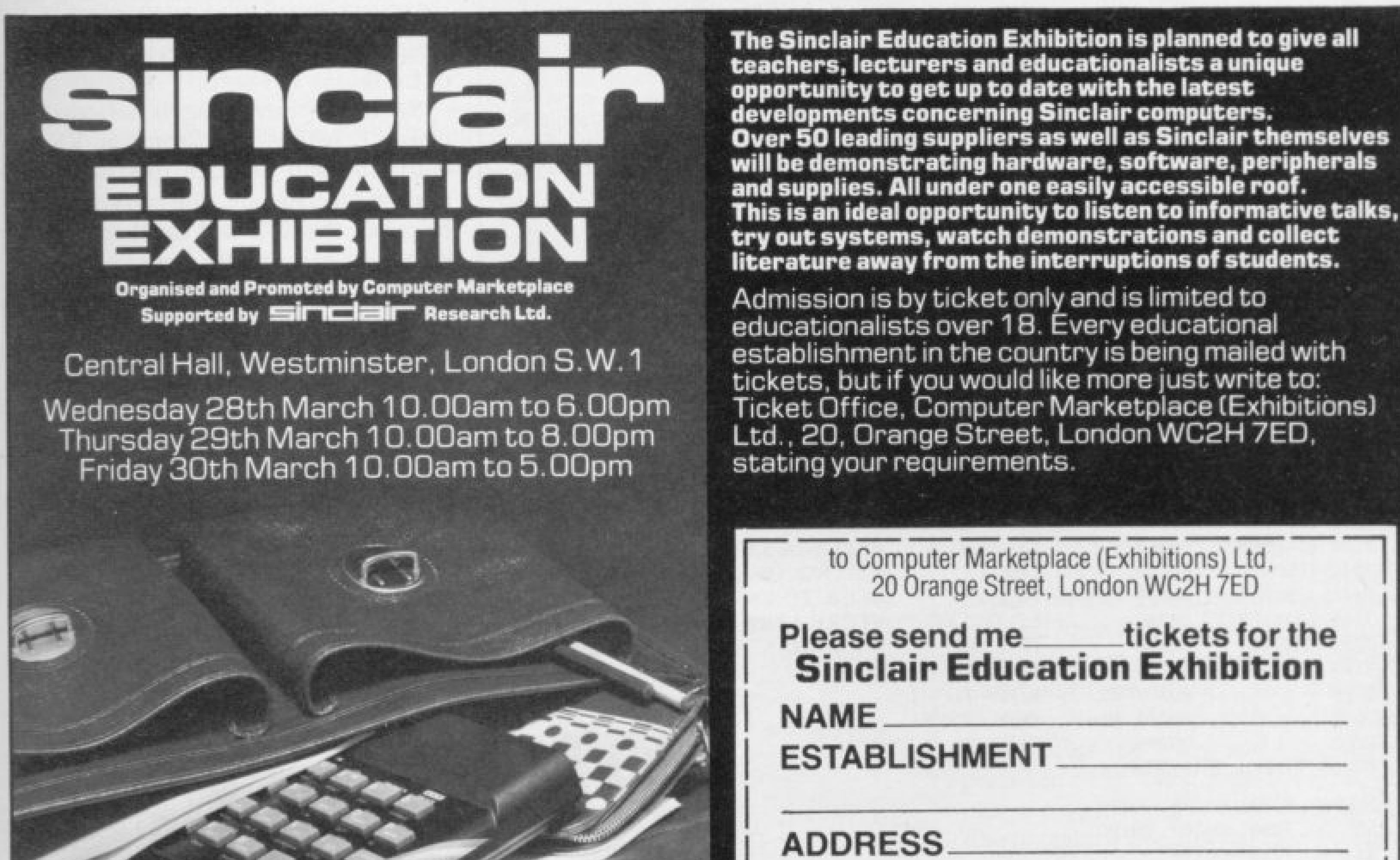
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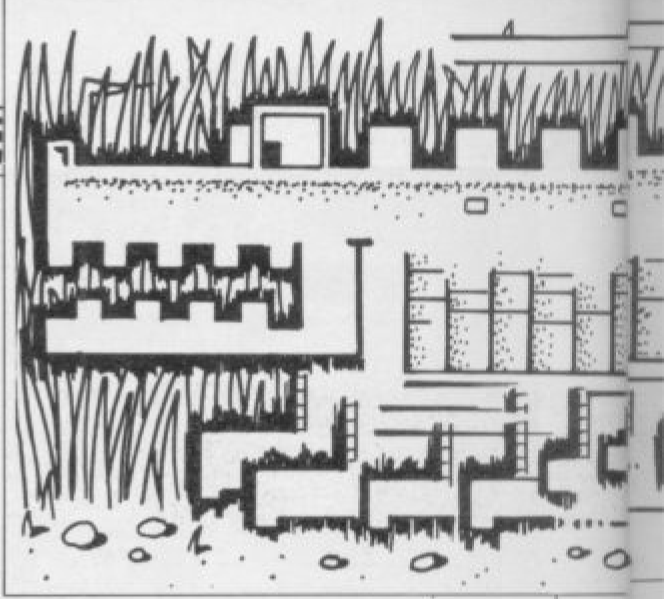
John Kerrigan continues his series

A MACHINE CODE routine for the fast display of large figures on the Spectrum screen was given last month. Now I want to make those figures shift slightly to the left or slightly to the right, one pixel at a time. The obvious applications for straight horizontal slides are birds or fish — characters which can swim or fly. Most moving characters will look better with some straight horizontal slides. A little man may walk across the screen with two frames alternating and creating each step. He will walk less jerkily if there are horizontal slides between each frame alternation.

The routine S4 in box one will perform a right slide. The routine S5 in box two will perform a left slide. Both routines depend on rotate instructions. The Z-80 has a much bigger instruction set than its main competitor, the 6502, which is used in BBC and Commodore machines. In particular it will perform several subtly different rotate instructions. The two we will use are RR for rotate right and RL for rotate left. Books on machine code normally discuss those instructions in the chapters which explain multiplication. That is because RR can have the effect of halving a number and RL has the effect of doubling a number.

To understand rotate instructions we must look again at every byte in its 8-bit binary form. The article in the February *Sinclair User* explained the relationship between hex numbers and their binary equivalents. The number 43 in normal counting or 2BH is 00101011 in binary.

Rotating right will ensure that the content of the most significant bit, bit 7, is placed in bit 6. The previous content



of bit 6 is placed in bit 5. The previous content of bit 5 is placed in bit 4 and so on until the previous content of bit 1 is placed in the least significant bit, bit 0.

So one would assume that rotating right 00101011 would produce 00010101, or 15H. The two unanswered questions in the last paragraph's description are what happened to the previous contents of bit 0 and what should be the new contents of bit 7. The different rotating right instructions in the Z-80 instruction set have different solutions to those unanswered questions.

RR uses the carry flag in its usual role of bit 8, as well as a sort of bit −1. That is rather like the ace which, in some card games, can be both the highest and the lowest card at the same time. The contents of the carry flag before the instruction are placed in bit 7 and the contents of the carry flag after the instruction will be the previous contents of bit 0.

So if the carry flag is set, that is equals 1, before the instruction, RR on 00010101 will produce 10001010 and, after the instruction, the carry flag will be re-set, that is it will equal zero. That means we can use the carry flag to take the pixel which "drops off" bit 0 of one byte and feed it to bit 7 of the next byte on the same scan. Of course, in screen memory, a 0 means paper and a 1 means ink.

There are several operands or which RR can operate. You can use the instruction on a register. So RR B and RR C are legitimate. RR B would perform the rotate on the byte held in the B register. The byte to be rotated would be the byte held in the register before the instruction and the result of the rotate would be the number in the register after the instruction.

S4, however, uses the instruction RR (HL). Previously I have said that brackets around a two-byte number or a register pair mean contents of. In other words the two-byte number is to be treated as an address in internal memory. In that case the rotate is to be performed on the contents of the ad-

Box 1.

SPECIFICATIONS S4 — Spectrum

GENERAL DESCRIPTION: Shifts the bits within a rectangle of the screen and pixel right. That makes any figure in that rectangle appear to slide to the right. The column of pixels on the left edge of the rectangle will all be re-set (= 0 = paper). The previous contents of the column of pixels on the right edge of the rectangle will be lost.

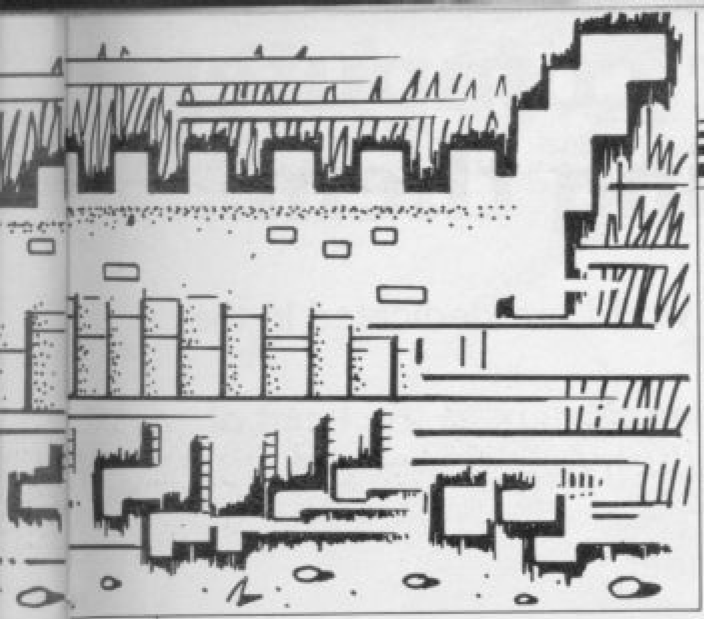
ON ENTRY: V1, a two-byte variable at 71F7H and 71F8H, must point to the top left of the rectangle in screen memory. V2, a two-byte variable at 71F9H and 71FAH, must be set with the low byte containing the no. of scans, or the height, of the rectangle and the high byte containing the no. of bytes per scan, or the width, of the rectangle. S0 (down a scan) must be in memory at 7000H.

ON EXIT: The slide is performed. V1 and V2 have their contents destroyed.

USES: A, B, C, D, E, H, L, V1, V2

```
7230              00100        ORG 7230H
7230 2AF771       00110 S4     LD HL,(V1)    ;LOCATION IN SCREEN MEMORY
7233 ED4BF971     00120        LD BC,(V2)    ;SIZE OF SCREEN AREA
7237 A7           00130 STSC   AND A         ;RESET C FLAG
7238 CB1E         00140 NEBY   RR (HL)
723A 23           00150        INC HL        ;MOVE RIGHT ALONG SCAN
723B 05           00160        DEC B         ;DEC NO. OF BYTES ON SCAN
723C C23872       00170        JP NZ,NEBY    ;BACK TO NEXT BYTE
723F 2AF771       00180        LD HL,(V1)    ;LOAD START OF LINE JUST SLID
7242 CD0070       00190        CALL S0       ;DOWN A SCAN/AS LAST MONTH
7245 22F771       00200        LD (V1),HL    ;STORE START OF NEW SCAN
7248 ED4BF971     00210        LD BC,(V2)    ;REPLACE B/BYTES PER SCAN
724C OD           00220        DEC C         ;DEC NO. OF SCANS LEFT
724D C8           00230        RET Z         ;BACK TO BASIC
724E ED43F971     00240        LD (V2),BC    ;STORE AREA LEFT TO SLIDE
7252 C33772       00250        JP STSC       ;BACK TO START NEXT SCAN
71F7              00260 V1     EQU 71F7H
71F9              00270 V2     EQU 71F9H
7000              00280 S0     EQU 7000H
0000              00290        END
00000 TOTAL ERRORS

NEBY   7238  00140  00170
S0     7000  00280  00190
S4     7230  00110
STSC   7237  00130  00250
V1     71F7  00260  00110 00180 00200
V2     71F9  00270  00120 00210 00240
```



dress pointed to by the HL register pair.

The advantage of using HL as a pointer in that way is that we can point HL to the start, or left-most byte, of a scan on the screen and then move right by INCrementing HL, rotating each byte in turn.

As we slide a scan one pixel to the right we must ensure that the new gap on the left is filled with paper. Line 130 of S4, in box one, is that instruction met in the February article : AND A. As explained, it has the effect of re-setting the carry flag. If the carry flag is zero, zero or paper is what will be placed in bit 7 of the first byte of each scan.

The two-byte variable V1 is being used in the same way we used it when displaying a figure. Before the routine starts it must point to the top left corner of the area we want to slide to the right. The two-byte variable V2, however, is being used in an odd way.

In a sense, it is two variables wrapped into one. One byte tells the routine the height of the area or the number of scans. The other byte tells the routine the width of the area or the number of bytes per scan.

You might wonder why the two pieces of information are both loaded together to and from the BC register pair. The reason is because it is not possible to load the register B directly from a point in internal memory — outside the machine code program — without loading its paired register. In fact, all such loads, apart from loads to the accumulator, must be to register pairs rather than to individual registers.

In those routines the BC registers are used in a typical fashion to count the number of passes round a loop. That is much in the way that FOR/NEXT variables are used in Basic. In line 160 B is DECremented. If that sets the zero flag, it effects the jump in line 170.

That use of the B register is so common that the Z-80 instruction set has an instruction which will combine the effect of line 160 with the effect of line 170. That instruction is DJNZ. It has the effect of DECrementing B and, if that does not reduce B to zero, performing a relative jump. In that case we could have replaced lines 160 and 170 with the single instruction DJNZ,NEBY. That would have been assembled as a two-byte instruction, whereas the routine in box one uses four bytes for the same effect.

One important difference between the slide left routine in box two and the slide right routine is that, on entry, V1 must point to the top right of the area to be shifted. That is because to slide left we must move across a scan leftwards, carrying the pixel of bit 7 of one byte into bit 0 of the next lowest byte.

Box three contains a Basic program to poke S4 and S5 into memory. It starts at line 270 so that it can be added to the Basic program in last month's article. Last month the alligator was displayed on the screen. This month it slides left if you press the l key and right if you press the r key. Next month we can get nearer a swimming motion with a routine to make it rise and fall scan by scan.

● *John Kerrigan runs courses in Z-80 Assembly Language. Details from Alligator Data Ltd, 01-674 8512.*

Box 3.

```
270 REM S4 MACHINE CODE
280 DATA 42,247,113,237,75,249,113,167,203,30,35,5
290 DATA 194,56,114,42,247,113,205,0,112,34,247,113
300 DATA 237,75,249,113,13,200,237,67,249,113,195,55,114
310 FOR A=29232 TO 29268: READ B: POKE A,B: NEXT A
320 REM S5 MACHINE CODE
330 DATA 42,247,113,237,75,249,113,167,203,22,43,5
340 DATA 194,104,114,42,247,113,205,0,112,34,247,113
350 DATA 237,75,249,113,13,200,237,67,249,113,195,103,114
360 FOR A=29280 TO 29316: READ B: POKE A,B: NEXT A
370 PAUSE 0
380 IF INKEY$="r" THEN POKE 29175,0: GO SUB 500
390 IF INKEY$="l" THEN POKE 29175,31: GO SUB 600
400 GO TO 370
500 POKE 29176,72: POKE 29177,14: POKE 29178,32
510 RANDOMIZE USR 29232: RETURN
600 POKE 29176,72: POKE 29177,14: POKE 29178,32
610 RANDOMIZE USR 29280: RETURN
```

Box 2.

SPECIFICATIONS S5 — Spectrum.

GENERAL DESCRIPTION: Shifts the bits within a rectangle of the screen one pixel left. That makes any figure in that rectangle appear to slide to the left. The column of pixels on the right edge of the rectangle will all be re-set (= 0 = paper). The previous contents of the column of pixels on the left edge of the rectangle will be lost.

ON ENTRY: V1, a two-byte variable at 71F7H and 71F8H, must point to the top right of the rectangle in screen memory. V2, a two-byte variable at 71F9H and 71FAH, must be set with the low byte containing the no. of scans, or the height, of the rectangle and the high byte containing the no. of bytes per scan, or the width, of the rectangle. So (down a scan) must be in memory at 7000H.

ON EXIT: The slide is performed. V1 £and V2 have their contents destroyed.

USES: A, B, C, D, E, H, L, V1, V2

```
7260                00100         ORG  7260H
7260 2AF771         00110 S5      LD HL,(V1)   ;LOCATION IN SCREEN MEMORY
7263 ED4BF971       00120         LD BC,(V2)   ;SIZE OF SCREEN AREA
7267 A7             00130 STSC    AND A        ;RESET C FLAG
7268 CB16           00140 NEBY    RL (HL)
726A 2B             00150         DEC HL       ;MOVE LEFT ALONG SCAN
726B 05             00160         DEC B        ;DEC NO. OF BYTES ON SCAN
726C C26872         00170         JP NZ,NEBY   ;BACK TO NEXT BYTE
726F 2AF771         00180         LD HL,(V1)   ;LOAD START OF LINE JUST SLID
7272 CD0070         00190         CALL SO      ;DOWN A SCAN/AS LAST MONTH
7275 22F771         00200         LD (V1),HL   ;STORE START OF NEW SCAN
7278 ED4BF971       00210         LD BC,(V2)   ;REPLACE B/BYTES PER SCAN
727C OD             00220         DEC C        ;DEC NO. OF SCANS LEFT
727D C8             00230         RET Z        ;BACK TO BASIC
727E ED43F971       00240         LD (V2),BC   ;STORE AREA LEFT TO SLIDE
7282 C36772         00250         JP STSC      ;BACK TO START NEXT SCAN
71F7                00260 V1      EQU  71F7H
71F9                00270 V2      EQU  71F9H
7000                00280 S0      EQU  7000H
0000                00290         END
00000 TOTAL ERRORS

NEBY  7268  00140  00170
S0    7000  00280  00190
S5    7260  00110
STSC  7267  00130  00250
V1    71F7  00260  00110 00180 00200
V2    71F9  00270  00120 00210 00240
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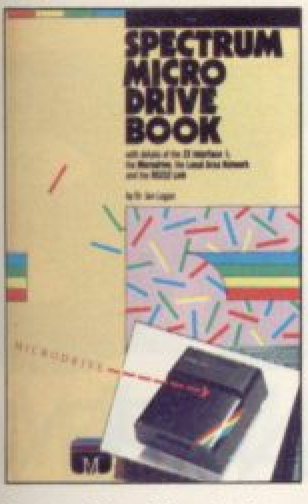
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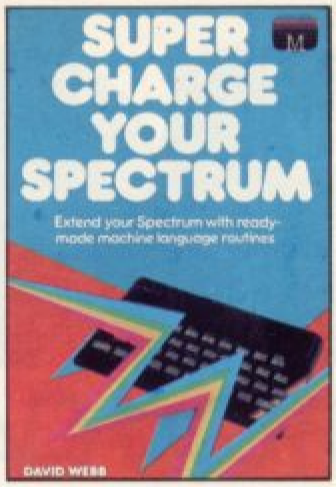
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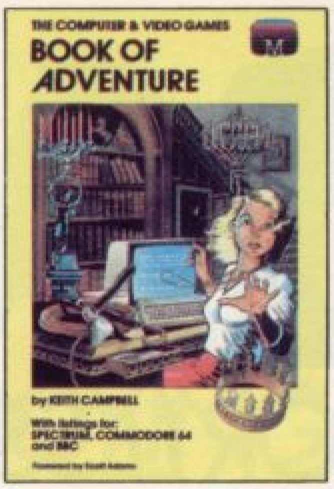
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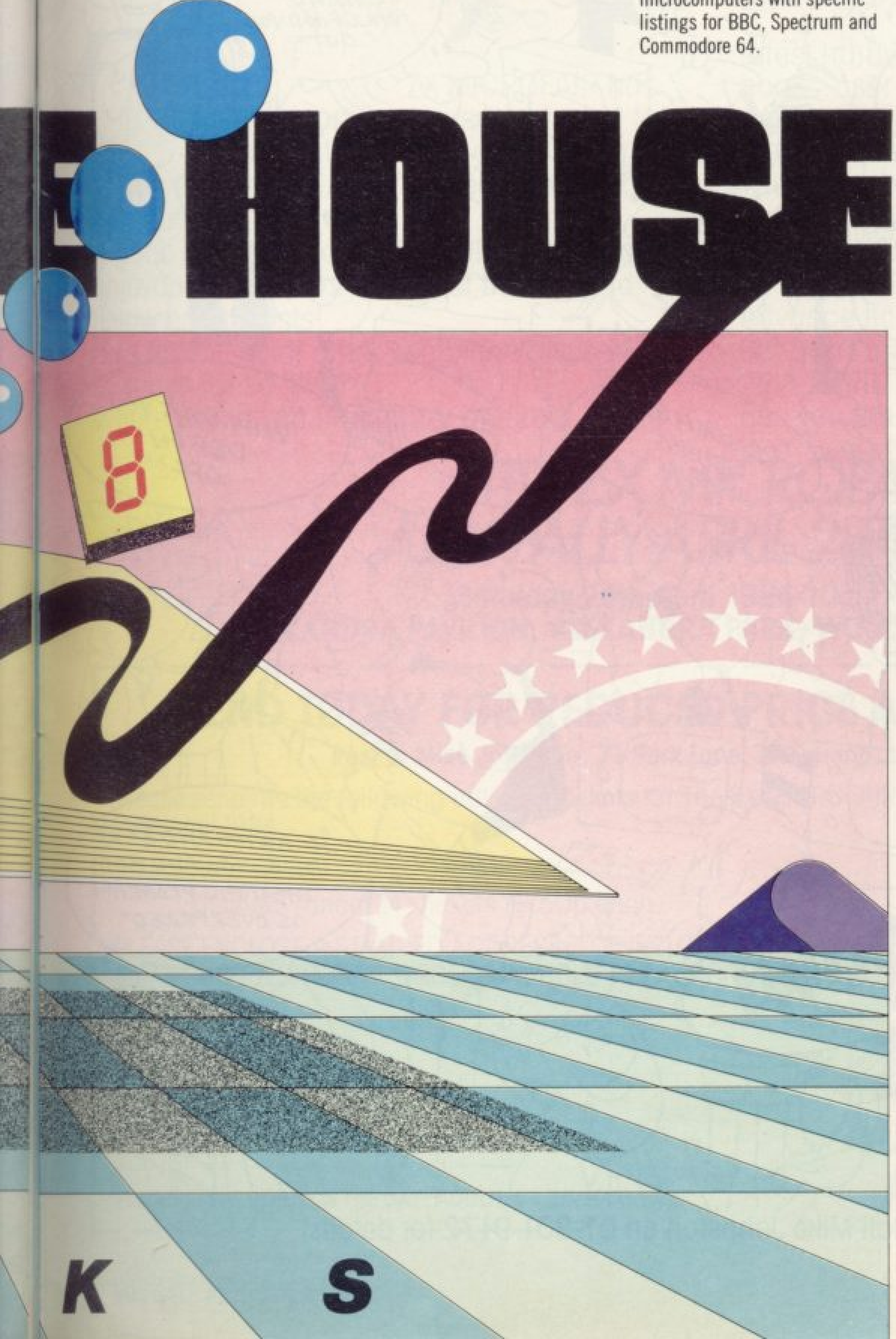
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Accounts manager

Mike Wright reports on a new private finance program

IF YOU are one of those who feel that your micro should be used for more than playing games, Fulwood Software has produced the Account Management System for the 48K Spectrum. It consists of two programs, the Master Control Program and the Data Control Program, one on each side of the cassette. The instruction manual covers a mere five sides of the cassette label and one of them is taken up on an introduction and explanation as to why there are two programs.

AMS is designed to keep a record of all the usual transactions which arise in keeping a set of private accounts. The system can cope with up to five accounts. They are set up initially as current account, deposit account, access, Barclaycard and building society, although a facility exists for changing the names in the MCP. Each transaction can be grouped into one of 26 categories, defined as a-z, and for each category a budgeting target can be set.

In addition to changing the names of accounts, the main purpose of MCP is to set up and keep track of standing orders. It is also used to record the transfer of money between the five accounts and to delete transactions. By comparison, DCP is used for recording the day-to-day transactions of writing cheques, using a cash card and crediting the accounts. It is also used to name the transaction categories, setting budget targets and checking how far apart are target and reality.

When AMS is first used, MCP must be loaded. Once loaded, it asks the user whether to load an old data file or to create a new one. Creating a new data file involves setting a starting date for the financial year, a password and the current date. The password, unfortunately, is only an added embellishment, since the programs can be broken into easily and a warm re-start achieved using GOTO 71, bringing the user back to the main menu. That gives the user seven options. The first five give access



to the five accounts, while six and seven save and verify the data. Option six ends the sessions after the save and verify while seven goes on to the load DCP.

Each of the first five options leads to the same subsidiary menu with four

> 'There is no display of the data once it has been entered'

options — add a standing order, amend a standing order, delete a transaction, and change account name. Each of those options then prompts for the appropriate input but there is no display of the data once it has been entered. The prompts for adding a standing order are:

IN or OUT of account — i or o.
Transfer account number — i.e., 1 to 5 corresponding to the main menu.
A four-character identifier for the standing order. Another two characters are added by the program to give an exceptional code.
The amount.
The frequency of payment, either 1 — monthly; 2 — quarterly; or 3 — annually.
The date of the first payment.
The number of payments.
The transaction category — a-z.
An 18-character description of the transaction.

Once that has been completed only the amount and dates of payment are shown and confirmation requested. The other options prompt in a similar fashion, although less information is usually required. Once the user is satisfied that the password and standing orders have been set the data can be saved and verified. If DCP is to be used it must then be loaded; the process takes about seven-and-a-half minutes.

DCP starts by inviting the user to press enter to load the data file. In fact, pressing enter causes the password to be requested before loading the data file. The main menu for DCP offers access to one of the five accounts or of closing and saving the data.

The subsidiary menu for the five accounts also offers five options. The first two allow the account to be credited or debited and lead to similar displays prompting for the date of the transaction, the amount, the cheque or

Continued on page 97

Continued from page 96

receipt number, the details — up to 18 characters — and the category — a-z — of the transaction. Once again the details are not shown after they have been entered, nor is the user asked to confirm them.

The third option gives the balance in the account on the current date. Option four allows for a statement to be printed for all transactions on a set date. That lists the transactions by date, number — the identifying cheque, receipt or standing order number — the amount, balance and whether debit or credit. Only a maximum of 10 transactions is shown on the screen at any time, with instructions on how to obtain more details or the next page or obtain a printout at the bottom of the screen. Unfortunately when a printout is obtained those instructions are also printed, so if more than one page of statements is required the overall cohesion of the presentation is spoiled. The last option allows, via another menu, transaction categories to be set up, named and assigned a budget target. It will also list the categories with their names and targets and compare the balance and target for any category graphically.



Despite the use of menus and prompts, AMS cannot really be described as user-friendly. While some error-trapping is built into the system, the major trap is the user. That can be illustrated by the fact that initially it will accept an amount with characters in it — e.g., £ u.89 — and then breaks down two or three steps later when it tries to use that value. It is regarded as satisfactory for February to have 29 days in a non-leap year. The overall impression is of a program which has been considered only from the point of view of what it will do but not how it is done or, perhaps most important, who is to use it.

Account Management System is available from Fulwood Software and costs £7.95.

Experience required for project planner

CPA software helps make business decisions

THE MAJORITY of business programs for the ZX-81 and Spectrum are based on the traditional areas of word processing, databases, spreadsheets and finance — payroll and ledger — packages. In a different area entirely the Hilderbay Critical Path Analysis program is more concerned with project planning.

CPA is a method of determining those activities in a project where a delay in the activity will cause a delay in the whole project. It can be applied to all projects where activities are started and stopped independently and which, in some cases, must be performed in a particular order. CPA has been used successfully in many fields. They include planning production, scheduling maintainence, town planning and construction. It can also be used for everyday tasks such as planning a shopping expedition or decorating, although its use in such areas is usually restricted to exercises for those being taught the methodology.

The program is designed for use by those who already have a background in CPA. That is made obvious by an impressive-looking manual which occupies two sides of A4 paper, with one of them devoted to background. Before the program can be run the usual network diagram shows the numbered activities and their duration, and cost if desired. The start and end points of the activities are also numbered independently.

> 'The program is easy to use but gives very little protection against typing errors'

Once the program has been loaded using LOAD "CPA", it asks whether a printout is required. Having entered either Y(es) or N(o) the master menu is displayed. That reminds the user of the elements of the network, gives instructions on how to get a warm re-start — i.e., without losing the data already entered — and the five options. They are SAVE problem on tape; LOAD problem from tape; enter a NEW problem; MODIFY existing data; SOLVE existing problem.

Initially the second option will be selected to enter a new problem. The program prompts for the number of activities in the network and also warns that existing data will be deleted. If that has been chosen by mistake, entering 0 returns directly to the master menu, keeping the old data.

After that the program continues to prompt for the start node, end node, duration and cost for each activity in turn. Once the data for an activity has been entered it is displayed with the activity number and the user is asked to confirm that it is correct.

Pressing any key except Y starts the data entry for that activity again. Once the data for the last activity has been entered the information for all activities is displayed. Pressing any key causes the calculation of the problem. When completed, the display shows the nodes of the activity, the earliest start time for the activity, the latest ending time, the float or amount of time an activity can be delayed without delaying the project and the cost.

Also shown is a critical path through the network and the cost of that path. Although the critical path is displayed on-screen, for some reason it is omitted from the printout; duration and cost remain.

The program is easy to use but gives very little protection against typing errors. The manual we received with the program makes a passing reference to an example. It seems to bear little relation to the figures in the manual. The program restricts the number of nodes to being fewer than the number of activities, which is not mentioned anywhere in the documentation but can be avoided by creating dummy activities with no duration.

Improvements could be made by printing all critical paths through a network and also by giving the user the option to add activities once a problem has been set up. CPA will analyse large networks reasonably satisfactorily provided the user is prepared to tolerate its limitations. For those who wish to use a more complete package, Hilderbay also produces the Project Planning Package at £120 plus VAT.

Critical Path Analysis is available from Hilderbay Ltd at 8-10 Parkway, Regents Park, London NW1 7AA and costs £15 inclusive of VAT.

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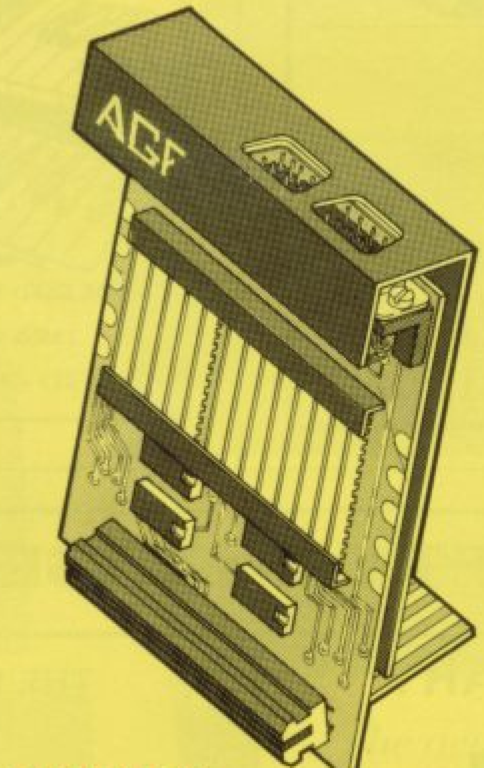
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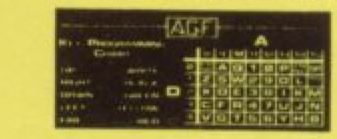


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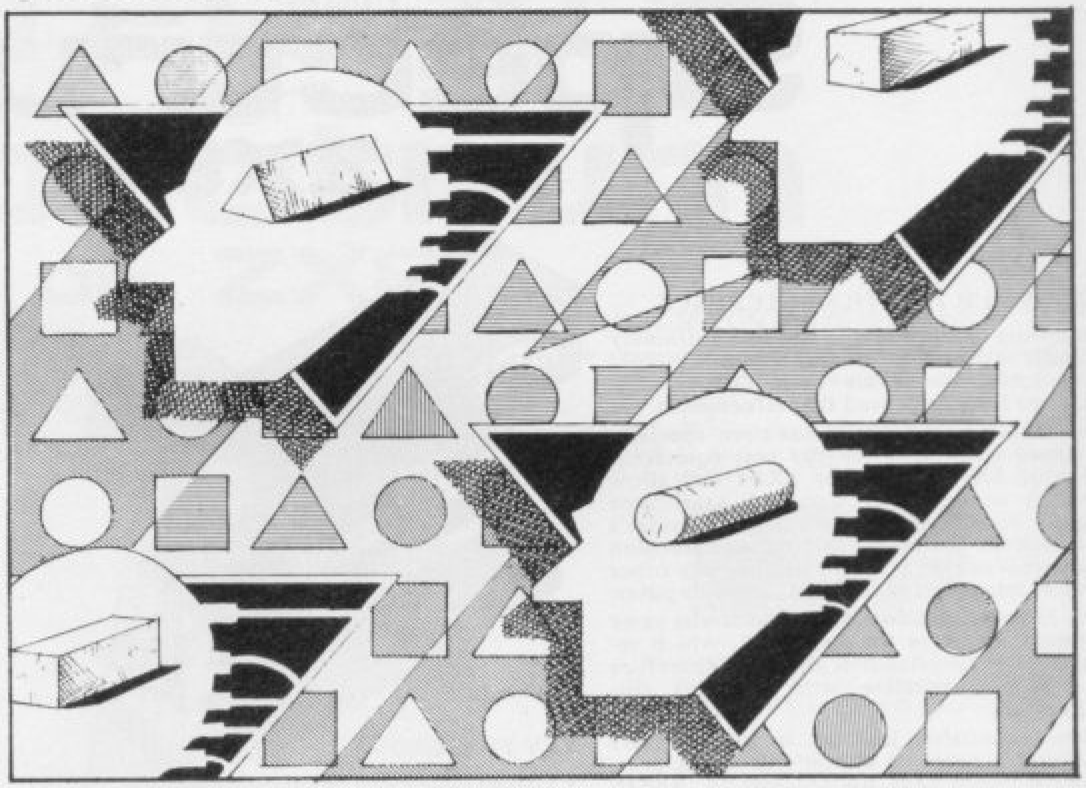
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Thinking

J McAllister describes how to teach a micro



THE PRECISE NATURE of human intelligence, and in particular the way in which humans learn, has been the subject of detailed study by psychologists and others for many years. With the advance of electronics and the growing power of computers, machine intelligence has become a matter of importance for engineers as well.

The two fields were united in the work of Alan Turing, who published the first detailed work on the theory and practice of game-playing by machines as an illustration to his fundamental question: can a machine think? Turing forecast that the development of high-speed computers would make possible the mechanisation of every form of thought process, an idea which was considered revolutionary, or even heretical, in the 1950s. Turing died before technology could provide the means for a practical demonstration of his ideas but many others, notably Shannon, carried-out related research through the years and today it seems possible that the machine may rival or even surpass the thinking power of the human brain.

The structure of many games make them good vehicles for the examination of thought processes. First we must exclude from consideration the arcade type of game, because those games, while calling for great ingenuity on the part of the programmer, are too restricted to provide real material for the idea of a mechanical type intelligence.

> 'After a given number of games the program is infallible'

Second, we should exclude the type of game where the computer is acting as a referee between human players, recording and storing moves and scores but taking no part in the game.

We might define the type of game in which intelligence plays an essential part as a contest in which each player has to devise a long-term strategy and react in the short term with suitable tactics to preserve the validity of the strategy in the light of an opponent's moves. Some games which would satisfy the definition are Noughts and Crosses, Five-in-a-row, Nim, Othello, Draughts, Chess and many card games.

They may be divided into two categories, completely specified and incompletely specified. In a completely-specified game it is possible to state whether, given correct play by both sides, the outcome is a win for player one, a win for player two, or a draw. Noughts and Crosses is a completely specified game which player two can always win or draw. At the other extreme, chess is incompletely specified because the total number of possibilities is so great that they have not all been computed.

For a completely specified game, an obvious method would be to store all the possible positions so that the machine could respond by evaluating them all before moving. The program would be shortened by eliminating no-hope moves. That type of program, though it may again call for great programming skill, could at most be considered to be the equivalent of the lowest form of animal instinct.

At a higher level there is the idea of compressing the strategy into a single rule or a set of rules for correct play. An example is to be found in Nim, where the strategy is compressed into a rule for preserving the parity of the binary representation of the position. That could be considered to be analogous to the human ability to abstract and generalise.

Probably the most powerful game-playing by machine is to be found in chess. Computer programs or machines dedicated to chess-playing are so far advanced that they can give grand masters a game. The more powerful the program, the further ahead it can look to analyse the position and the more complex are the various compressions of strategy with which it is equipped.

To qualify as intelligent, a machine or program should not only have the ability to analyse, abstract, generalise, remember and compare, but also the ability to improve with experience—that is to learn. A program with that ability eventually will be able to do things which it was not programmed originally to do and it is in that aspect that future advances in mechanical intelligence are likely to be made.

A famous short story of a few years ago, Flowers For Algernon, dealt with a mentally defective boy who found himself transformed for a short period into a genius but eventually relapsed into a moronic condition. Initially the program of that name has no idea of how to win a game but after a few games its play improves; and, after a given number of games, variable by the programmer, it is infallible, being in possession of the perfect compressed strategy.

The game is trivial and of no great interest, the main point of the program

of Algernon

being how the machine learns to play correctly. Two players take turns to remove objects from a pile of 21 and the loser is the player who has to take the last object. It is a completely specified game with a very simple strategy which results in a win for player two.

A player may taken one, two or three objects at a time, so all player two has to do is to remove a number to bring the total removed on that turn to four. Then, after five turns, 5×4=20 objects have gone and it is left to player one to take the last.

Only a complete idiot could fail to win as player two if he was in possession of that simple rule. That is what the machine is initially and, if left with three objects, it is as likely as not to take all three and say "you win".

The program, however, while not equipped with the perfect strategy at first, is equipped with the means to discover it — intelligence? — and as the number of games played increases it begins to improve until eventually it plays faultlessly.

In the program, line 10 and the subroutine give instructions and may be omitted.

Lines 15-25 initialise.

Lines 30-45 and the variable Z prevent foul play by the human player.

Lines 40-75. The variable M decides whose turn it is — M=O means the human to play. K is the number taken and if legal that is subtracted and the remainder is displayed. M is also used in the learning process.

> 'The field of artificial intelligence has many fascinating aspects'

Lines 80-120 decide the machine's move. That is random but within the rules so long as C is less than 10. If C is equal or greater than 10, the machine makes the perfect move contained in line 85.

Lines 125-145 decide who has won, print a message and adjust C. The variable C increases by 2 if the machine wins and by 1 if the human wins. That is in accord with the theory that learning is promoted by encouraging favourable responses. If desired, it could be arranged that C was either left at its old value or even decremented when the machine lost.

That would mean that the machine would have to win games through mistakes on the part of the human to learn and might be preferable if the game is to be played by children.

Line 145. It is essential to input "Y" at this stage if the machine is to learn, since each time the program is RUN all variables are initialised and the program relapses into idiot status.

The field of artificial intelligence is one which has been largely neglected by amateurs but it has many fascinating aspects and is an area in which the amateur could make a real contribution to computing. Think of the discoveries which have been made by amateur astronomers, for instance.

An immediate development of the program would be to allow the machine to play first in its turn. In their case it could not be equipped with a perfect win strategy, nor with the means to discover one, but an interesting possibility would be to program it to learn to play an optimum game — to take advantage of any mistakes by the human opponent to reach a winning position.

The program and developments of it should also provide useful material for young children working with numbers.

```
10 GO SUB 175
15 FLASH 0:CLS
20 LET C=0:LET Z=0
25 LET N=21: LETQ$="21 graphics 5:" PRINT Q$
30 IF Z=1 THEN PRINT: PRINT "Play the game. Take 1, 2 or 3, but not more than the
total."
35 PRINT "You take?";
40 LET M=0:INPUT K: PRINT K;:
LET Z=0
45 IF K>N OR K<1 OR K>3 OR K<>
INT K THEN LET Z=1
50 IF Z= 1 THEN GO TO 30
55 LET N=N-K: LET Q$=Q$ (TO N)
60 PRINT "which leaves"; N
75 PRINT Q$
80 LET M=1: LET P=1+INT (3*RND)
85 IF C>9 THEN LET P=4—K
90 IF N=2 THEN LET P=1
95 LET N=N—P
100 INPUT "Press ENTER for my move"; RS
105 PRINT "I take ";P;" leaving ";N
110 LET Q$=Q$ (TO N): PRINT Q$
115 IF N<2 THEN GO TO 125
120 GO TO 35
125 LET D=D+N
130 IF D=1 THEN PRINT "You win."
135 IF D<>1 THEN PRINT "I win,"
140 LET C=C+D
145 INPUT "Play again? (Y/N)"; A$
150 IF AS="Y" OR A$="y" OR A$="" THEN CLS: GO TO 25
155 PRINT "Thanks for the game.": PRINT:PRINT
160 STOP
175 PAPER 7: INK 0:PRINT "This program demonstrates the ability of machine to learn
from experience. A very simple game is used as an example."
180 PRINT "In this game two players take turns to remove 1, 2 or 3 bricks from a row of 21.
The player who takes the last brick loses."
185 PRINT "With correct play the result should always be a win for player two (the
machine), but the machine does not know this to start with and is likely to make stupid
mistakes."
190 PRINT "The machine learns from experience and eventually it cannot be beaten. To
allow this to happen, you must press key Y when asked to play again."
195 INPUT "Press ENTER to start, A$:RETURN
```

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ELSE	— used with IF. . .THEN.
GET	— waits for keyboard entry; doesn't use ENTER.
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ON ERROR	— allows trapping of most reports; has available ERROR, LINE and STAT variables.
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Theodora Wood assesses teaching programs for older children

The classroom

As CHILDREN pass into their teens the limitations imposed by lack of basic skills are no longer applicable. Programs therefore can be produced with a far greater proportion of written text. Following from programs designed for younger children, many packages rely on the demonstration and examine formula and there is far less emphasis on the entertainment aspect. This month, I shall look at programs which are complementary to school work up to O level. Some incorporate games, some are straight revision packages, others are demonstration models.

Astro Maths — Spectrum 48K, ZX-81, Scisoft £6.95 — illustrates how software houses have mixed games with learning, appealing to the games player by offering a reward for correct answers in the form of zap-the-alien-ships. Unfortunately, although the graphics of the spaceships seem exciting when first shown, the game is a pale shadow of games available. The ships do not appear on the screen and the player is presented with an X to move over an invader which is only a square. Control of movement by means of a cursor is also rather shaky and slow.

The bulk of the program is concerned with testing in two areas — decimals to fractions and percentages. Parameters range from easy to difficult and the time-span for answering the questions can be as little as 20 seconds to as much as five minutes 20 seconds. Fractions to decimals deals with questions such as "Type-in the following fraction as a decimal — 20/41 = ?".

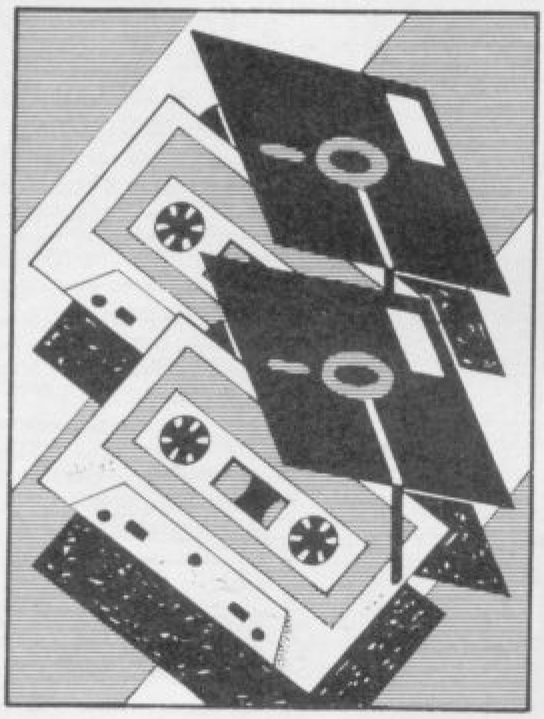
The program notes suggest that calculators could be used and for this kind of fraction a calculator would certainly save a great deal of time spent in long division, though obviously it provides practice in it. Percentages tests knowledge in this area by such questions as "What percentage of 200 is 14?". The game is the same and also the parameters, which unfortunately cannot be changed without reLOADing the program.

By contrast, **Mathskills II** — Spectrum 48K, Griffin, £9.99 — is a no-nonsense revision package aimed at complementing courses up to O level in mathematics. The subjects dealt with are areas, perimeters, simple equations, percentages, sets and Venn diagrams. Operating rather like a textbook, instructions are given at the beginning of each section, and even when attempting the questions there is a help facility in case the formulae have been forgotten — a useful revision aid.

After each question has been answered there is the game, different for each section. It is in the form of a ball reaching a goal if five correct answers are given, as in the case of percentages.

Although not really a game in the interactive sense of the word, that diversion breaks up the tedium of answering questions, giving a short break between each one. When the student has completed a section, a certificate is displayed giving the number of questions answered correctly or incorrectly, also expressed as a percentage.

The section on sets and Venn diagrams is especially clear and would certainly be an aid, not only to students,



but also to parents whose own school curriculum did not cover these concepts.

Sequencing — Spectrum 48K, Chalksoft, £6.95 — demonstrates the textbook formula by providing examples of sequences, halving, Fibonnacci, prime, square, triangular and multiples of three and nine. Two or three pages of explanation precede each sequence being displayed on the screen. Unlike Mathskills II, which uses the computer to act as a marker, thus pinpointing areas of the subject which need more revision, this is a demonstration tape and has no inherent advantage over a textbook, except that the student sees the sequences built on the screen rather than being presented with the complete set of figures on a page.

For a complete teaching package, **Angle** — Spectrum 48K, Chalksoft,

'A demonstration tape has no advantage over a textbook'

£11.25 — attempts an introduction to the concept of angle. Four programs are included in the package. Program A demonstrates the concept graphically by showing circles turning through quarters, halves and full turns, and when that has been done the idea of degrees is introduced.

Then follows a program to test these ideas based on a multiple-choice format. Program C moves into a demonstration mode to explain the use of a protractor to measure angles with graphics demonstrations. The testing mode in program D, however, reveals how closely a textbook format has been followed and the user has to hold up a protractor to the television screen to measure the angles. Come back pen and paper, all is forgiven.

Arnold Wheaton's **Angle Turner** — Spectrum 48K, £13.95 — covers the same ground but has strategies for testing which are not so tied to the conventional. Designed originally for use in the classroom, it is a thorough exploration of the concept embodied in its title. Two tapes and a users' handbook are included.

The demonstration package operates on a menu. The user has a choice of quarter turns, right angles, 45-degree, 10-degree and one-degree turns. The practice mode is designed "to reinforce the concept of angle as a quantity of turn" and test on each of the demonstration models, identifying such aspects as how many right angles?

EDUCATION

keys

For more complicated options of 10- and one-degree units the computer draws an angle and the user is asked to estimate the angle. The margin of error can be fixed at the beginning of the program, as can the number of incorrect attempts before help is given in the form of calibrations round the circle so the pupil can count. Calibrations also reinforce a correct answer. After eight questions, or whatever number set, the mode changes and the pupil has to stop the circle being drawn when it reaches a given angle.

The tutorial program draws a shape and gives the number of degrees in digital form at the side; the child has to study the shape and then it is re-drawn; pressing any key will stop the drawing process at the desired point. There is a danger that children will just match the reading given in a box to the one required but pressing T will hide the shape readout and prevent that. The packaging is excellent and although that is no guide to the quality of the program, good design is always a delight, no doubt reflected in the price.

Another area which is susceptible to rote learning and testing is that old chestnut of French irregular verbs and their changes through the tenses. **Tense French** — Spectrum 48K, Sulis Software, £9.95 — would be equally useful at home or in the classroom. Once LOADed there is a menu with choices of change of tense — the program starts in the present tense; a list of verbs; tests on meanings; test on one verb; and a test on all/some verbs.

The choice of tenses covers the range, including the subjunctive. Once a tense has been chosen, either of the two testing situations can be chosen. When choosing one verb the user is presented with the verb of his choice and has to type-in the correct form of the verb after the initial preposition has been given. A score out of eight is built at the side of the screen and at the end of the exercise there is a choice of analysis or the menu.

The analysis option is useful, as it shows the correct forms of the verb which have been entered incorrectly by use of a bar of colour, thus highlighting the forms which need revision. Accents, circumflexes and cidillas are obtained by entering graphics mode and pressing the appropriate key.

The list of verbs shows all the verbs to be tested and the tests on meanings does precisely that, from English to French or vice versa. Tense French covers that area of revision in a thorough way and would certainly help users to concentrate on those forms of verbs where they had a weakness, even into the realms of the past historic.

Buying commercial programs can prove to be expensive, however, and for keyboard wizards there is the alternative of writing their programs. *Educational Uses of the Spectrum*, a Sinclair computer guide, by Tim Hartnell, Christine Johnson and David Valentine — John Wiley, £6.95 — would be of great assistance in writing programs such as those reviewed.

The first five chapters deal with basic programming, which would be superfluous for anybody who had worked through the Spectrum manual. The section on using the Spectrum for advanced mathematics includes routines to cover series, square roots and quadratic equations, as well as graphics sections to cover such concepts as sine design and tangent curves for demonstration purposes.

Testing routines are also supplied and there is a useful section on primary school work with the Spectrum. The book is designed for parents and teachers and, although the price is high compared to works of fiction, it is about average for a computer publication, and the savings would be considerable if the routines were used in place of commercial software.

'The immediacy of feedback to the user would not only save hours of classroom time but also be of assistance at home for revision'

Examples of software produced for the older child for the Spectrum have an immediate advantage over traditional methods in the immediacy of feedback to the user, and programs such as Mathskills II and Tense French would not only save hours of classroom time spent in testing but also be of assistance at home to identify and revise areas where a pupil was having difficulty.

It has to be said, however, that there is a relative dearth of secondary software produced so far. The market in the field has been dominated mainly by the smaller software houses, as the larger educational suppliers have been producing mainly for the school market, mostly for the BBC micro and the Research Machines models.

That is likely to change as software houses 'Spectrumise' programs previously available only to schools. Heinemann has started the trend by adapting programs such as **Car Journey, Ballooning** and **Special Agent** for the age range up to 13 from a suite of programs produced by a team of teachers working at Dudley, called The Dudley Programs, and tentative plans are afoot to adapt more titles. **Understanding Your Weather, Dairy Farmer** and **Town Planner** are three of the possible candidates. Arnold Wheaton is inclined to do the same.

There are many titles available in the games section which are educational without relying on the demonstrate-and-examine formula. Programs such as **The Hobbit** develop problem-solving skills and encourage a logical approach, without being specifically educational packages.

Title	Machine	Publisher	Price	Gilbert Factor
Astro Maths	Spectrum 48K ZX81	Scisoft	£6.95	6
Mathskills II	Spectrum 48K	Griffin	£9.99	7
Angle	Spectrum 48K	Chalksoft	£11.25	5
Angle Turner	Spectrum 48K	Arnold Wheaton	£13.95	7
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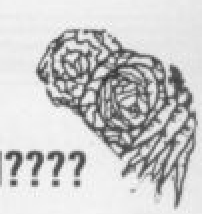
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Campbell J A	Guess	secret
Campbell Syste	Programs	secret
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Ding J	Admin	9000
Ewing J R	Chairman	90000
John	Sales	15500

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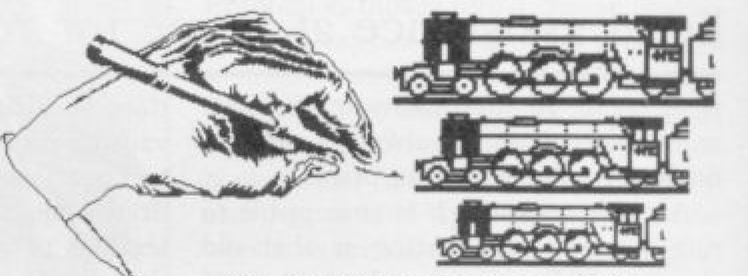
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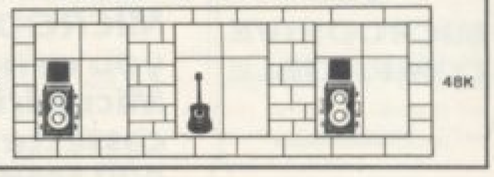
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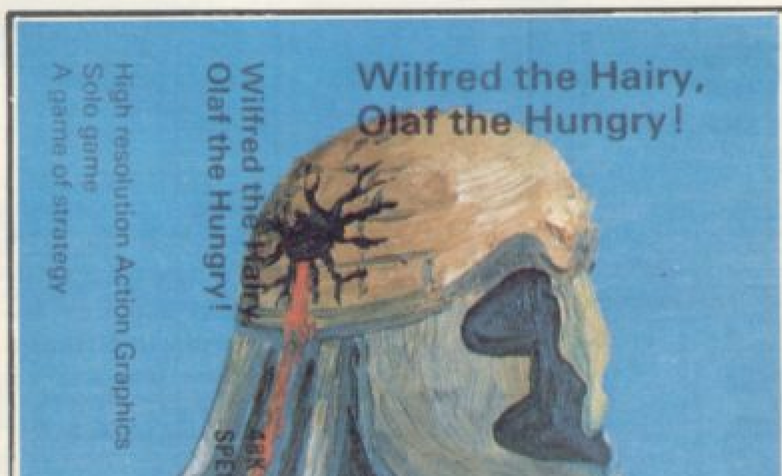
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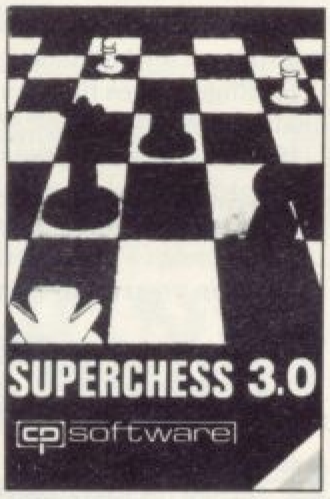
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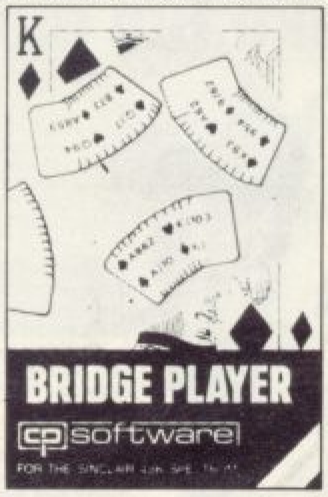
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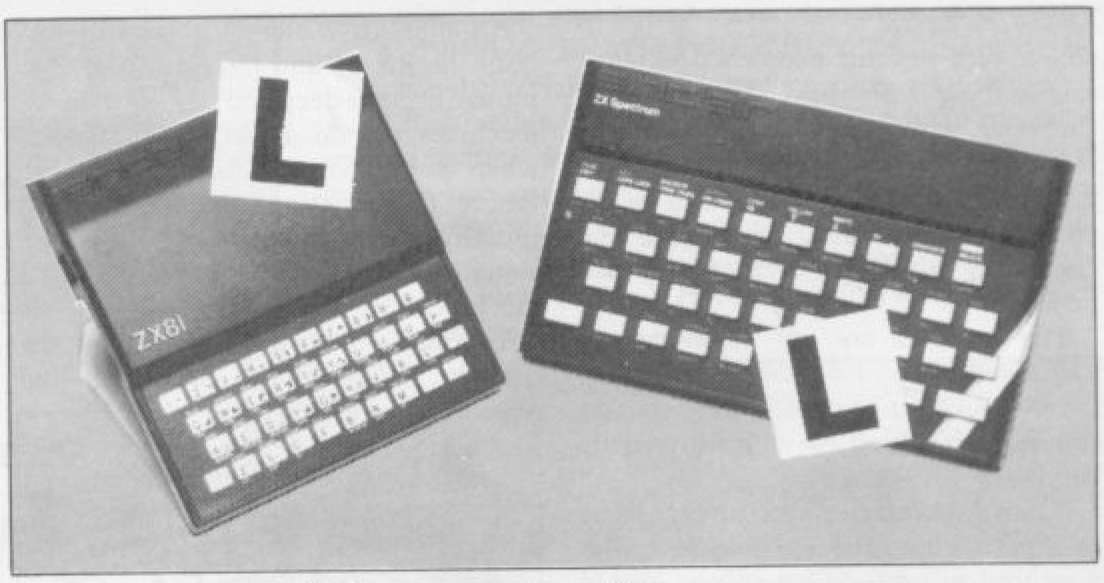
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GLOSSARY

Basic — Beginners' All-purpose Symbolic Instruction Code. A programming language resembling English which is used by beginners because most popular microcomputers have it as standard.
Bug — an error in a program.
EPROM — Erasable Programmable Read-Only Memory. Semi-permanent storage. Information is not erased if the power is turned off in the computer. Programs can be erased by subjecting the memory chips to ultra-violet light. The memory can then be re-programmed using an electrical device called an EPROM blower.
Interface — RS232 and Centronics. A device which enables other computers or add-ons, such as printers, to be connected to the computer. It converts non-standard signals from add-ons to the standard signals of the computer in use.
Kilobyte — (K). A measurement of memory size. Most machines use 16K as a minimum but 48K is generally agreed to be necessary for serious work.
Machine code — an electronic pulse code used by the computer to perform functions and communicate with memory and other devices.
Mnemonics — abbreviated instructions — for example LD for Load — used in machine language programming.
Motherboard — an external printed circuit board which is used like a multi-way plug planner. It enables other printed circuit boards, such as graphics boards and colour boards, to be slotted-in.
Port — a link to the outside world which can be used by programs and the computer.
PCB — printed circuit board. A board which has on it the electronic circuits of the computer.
RAM — Random Access Memory. Information and programs can be stored in this type of memory as electronic pulses which conform to a set of numbers — machine language — in which programs are represented in the computer. When the power is turned off the information will be lost.
ROM — Read Only Memory. Information stored in this type of memory is not lost when the power is switched off.
Software — programs which control the operation of the computer.
Syntax error — a bug caused by incorrect use of a programming language.



Our easy-to-follow guide for new owners

The basic route to a habit-forming hobby

BUYING a Sinclair machine can be the start of a life-time's obsession with home computing. It is easy, however, to become discouraged if everything does not go according to plan from the beginning.

For those with only a little knowledge of computers and their capabilities, the best way to approach the machines is to abandon any ideas for special uses. While the 48K Spectrum is big enough for simple uses in small businesses, the range of Sinclair computers does not contain machines for major uses. It is better to become accustomed to the many facilities and then decide how you wish to use them.

Begin by unpacking your machine, overcoming your surprise at its size and weight and, following the manual, set up the system. If you cannot get the K on the screen, check that everything is plugged into its correct socket and re-set the machine by pulling-out the power plug for one second and try tuning-in again. If still nothing appears, check the power supply unit by shaking it. If it rattles, return it. If it is satisfactory, check your system with that of a friend.

If you have a Spectrum you will have received an introductory booklet which explains what the computer can do and giving detailed instructions on how to set it up. Also included is a fault-finding guide.

Once the K appears you are ready to begin learning about your machine. It can prevent family arguments if you can afford a separate television set for your system. It also makes life easier if you find somewhere to leave your equipment set up permanently. You will find that a few power sockets are needed and a four-way block connector on a short length of extension cable will help to tidy trailing leads.

When using a Spectrum, a television set has to be more finely-tuned than when using a ZX-81 because of the added dimension of colour. If the set is not tuned properly, the colours will look hazy instead of sharp and clear. If no colour can be seen when it is switched on, the power supply or the television set may be at fault.

Some users have experienced some difficulty with some television sets, which include Hitachi, Grundig and Toshiba. Sets which many people have found compatible include the Sony Trinitron, Fidelity and Ferguson. Recent changes in the ULA should make more sets compatible.

The manuals are written in great detail and are reasonably easy to follow. Some of the chapters may not seem immediately relevant but it is worthwhile reading them as you might miss something important.

Patience is needed at that stage to learn the ways in which the computer will accept information. It is tempting to try to enter programs before you are ready but that is likely to lead to errors. For example, words like AND, THEN and AT should not be typed-in letter by letter.

By the time you have reached chapter 11 in the ZX-81 manual and chapter 19 in the Spectrum manual you should have accumulated sufficient knowledge to be

continued on page 114

continued from page 113

able to type-in other people's programs, such as those in *Sinclair User* and *Sinclair Programs*, without too much difficulty.

It is important when using the ZX-81 that it is not jolted. Some of the connections can easily work loose and everything which has been entered will be lost.

The manuals are not to everyone's liking and if you find them difficult to follow a number of books on the market can help you. Find the one which suits you best.

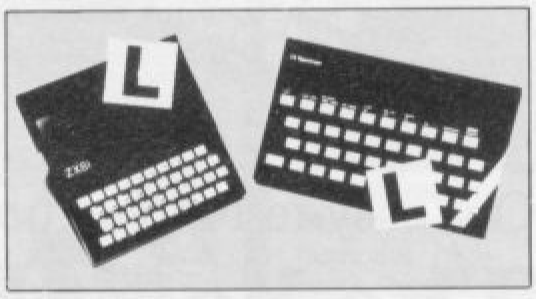
As a way of relaxing you can buy some of the growing range of commercially-produced software. That can be loaded directly from cassette but make sure that your machine is big enough to take the tapes you buy.

For the ZX-81 there are a few tapes for the unexpanded 1K machine but the majority require the 16K RAM pack. Similarly on the Spectrum most companies are taking advantage of the possibilities provided by the larger 48K machine rather than providing cassettes for the 16K.

The tapes can vary in quality and it is advisable to read the reviews in *Sinclair User* and use your judgment to find the best.

An alternative method to learn about both the ZX-81 and the Spectrum is to plunge in at the deep end and see what the machines will do. Refer to the manuals when you have difficulties. You can ignore the functions and calculations initially and experiment with PRINT statements to obtain the feel of the machines.

You may already have heard about the problem involved in SAVEing and



LOADing your own cassettes. The manual gives detailed instructions but many of the early ZX-81s would not accept tapes from some recorders. That problem is said to have been overcome but there can still be difficulties.

Usually they occur when LOADing tapes recorded by other people. One simple method to overcome this is to wind the tape to the middle of the program and type LOAD " " followed by NEWLINE; then increase the volume of the recorder slowly with the tape running until the television screen shows four or five thick black bands. If you then re-wind the tape, the program should LOAD normally.

LOADing and SAVEing on the Spectrum is much easier and faster than the ZX-81. One difference is that when SAVEing on the Spectrum the LOAD lead must be disconnected either at the recorder or the Spectrum.

Finally, a health warning. Apart from any practical uses, computing with your Sinclair machine can be a very entertaining hobby and is almost certainly habit-forming. You may easily find yourself crouched over your machine, red-eyed, in the early hours of the morning thinking that in another five minutes you will solve the problem. Try to break that habit by getting into the fresh air and meeting other Sinclair users.

By obtaining a Sinclair computer you find that you have joined a not very exclusive club with many thousands of members, many of whom would be only too happy to advise you if you have difficulties.

Make sure of your regular copies of *Sinclair User* and *Sinclair Programs* and you can be guaranteed many happy hours.

CROSS COUNTRY

YOU ARE a cross country runner represented by a 'v'. Part of the course you run includes a field full of cows. Avoid the cows as they rush towards you to complete a successful run and to reach home safely.

Cross Country was written for the unexpanded ZX-81 by Timothy Green of Sandy, Beds.

```
  3 FOR F=1 TO 60
  4 IF F=60 THEN GOSUB 10
  5 NEXT F
 10 LET H=16
 20 LET S=0
 30 PRINT AT 21,INT (RND*31);"*
"
 40 PRINT AT 10,H;
 50 IF PEEK (PEEK 16398+256*PEE
K 16399)=23 THEN GOSUB 120
 60 PRINT "V"
 70 SCROLL
 80 IF INKEY$="5" THEN LET H=H-
1
 90 IF INKEY$="8" THEN LET H=H+
1
100 LET S=S+1
101 IF S=500 THEN GOSUB 500
110 GOTO 30
120 PRINT AT 9,H;"(9y:sP:9t:30*
sP:9t:1sP:9t)"
130 PRINT AT 12,0;"BAD LUCK/PRE
SS NEWLINE TO PLAY"
140 INPUT Z$
145 CLS
150 GOSUB 10
500 PRINT AT 12,0;"WELL DONE/RU
N COMPLETED"
505 PRINT AT 16,H;"(1sP:9w:30*1
sP:95:2*1.:95:20*1sP:9t:2*97:9w)
"
510 PRINT AT 14,0;"PRESS NEWLIN
E TO PLAY"
520 INPUT X$
525 CLS
530 GOSUB 10
```

SLEEPING BEAUTY

SLEEPING BEAUTY is a 1K adventure game by Kevin Wright of Northgate, Hull who wrote it because his friends believed a 1K adventure game written in Basic was impossible to program. The object is to reach the princess who is sleeping in the castle. You must kill the ogres who are placed along your route by the wicked fairy. You are armed with the swords which are distributed by good fairy. Lower-case characters represent inverse letters.

```
   2 LET B=NOT PI
   3 LET S=NOT PI
   5 LET X=INT (RND*CODE "A")
   6 IF X>CODE "2" THEN LET X=-X
   7 LET Y=INT (RND*CODE "A")
   8 IF Y<CODE "2" THEN LET Y=-Y
   9 LET D=SQR (X*X+Y*Y)
  10 PRINT INT D;"km->castle"
  11 PRINT "N/S/E/W?"
  12 GOSUB CODE "A"
  13 LET X=X+(D$="N")-(D$="S")
  14 LET Y=Y+(D$="E")-(D$="W")
  15 IF X=NOT PI AND Y=NOT PI TH
EN GOTO CODE "9"
  16 LET D=INT (RND*CODE "$")+PI
/PI
  17 LET D$=("OGRE" AND (D<VAL "
6"))+("SWORD" AND (D>VAL "5") AN
D (D<VAL "9"))
  18 IF D>=VAL "9" THEN GOTO VAL
 "9"
  19 PRINT "found";D$;"n\l"
  20 IF D$="OGRE" AND S=PI/PI TH
EN GOTO CODE "O"
  21 IF D$="SWORD" THEN LET S=PI
/PI
  22 IF D$="SWORD" THEN GOTO VAL
 "9"
  23 IF D$="OGRE" THEN PRINT "wa
it(7)run(6)"
  24 GOSUB CODE "A"
  25 IF D$="7" OR D$="6" THEN GO
TO CODE D$
  26 IF D$<>"" THEN GOTO CODE "7
"
  27 GOTO VAL "9"
  28 LET S=NOT PI
  30 LET B=B+PI/PI
  31 PRINT "OGRE DEAD BY SWORD"
  32 GOSUB CODE "A"
  33 GOTO VAL "9"
  34 IF RND*VAL "9">PI/PI THEN G
OTO VAL "9"
  35 PRINT "dead"
  36 STOP
  37 PRINT "princess
wake";B;"d
ead ogre"
  38 INPUT D$
  39 CLS
  40 RETURN
```

The variables

A VARIABLE is a location within the computer memory which stores a value such as a number or a string of characters.

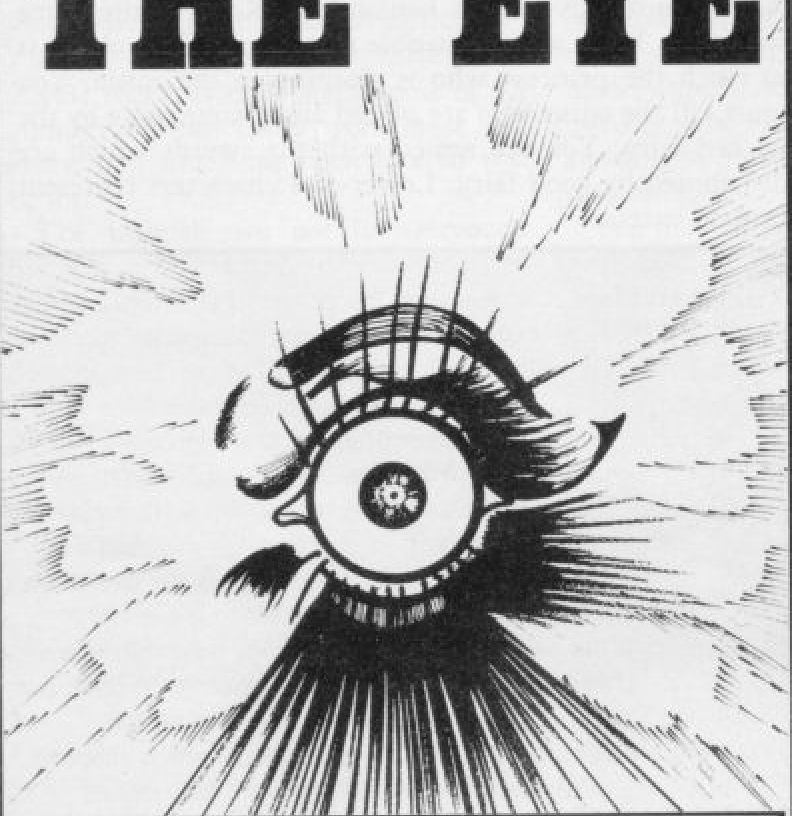
The variables used in the program are:

B	the number of battles fought and won.
S	if you own a sword then 'S' will equal 1. Otherwise, S will equal 0.
X and Y	Those contain your co-ordinates on the castle floorplan grid.
D	That will be used for different purposes during the program, but it is used mostly to hold the value of your distance from the castle.
D$	A chain or string of characters which indicates the direction in which you are travelling.

The Program lines

2 and 3	make the values of B and S equal to 0.
5-8	put random position numbers in X and Y.
9	uses the square root function to find your distance from the castle.
10 and 11	display your position and the directions in which you can move on the screen.
12	calls the subroutine, a program within a program, starting at line 38. That routine will prompt you to enter a string of characters which will be put into the variable D$.
13 and 14	find your new position on the map grid.
15	if X and Y both equal 0 then you have reached the castle. If that condition is true, go to line 37; if not, continue to next line.
16	finds a random integer between 1 and 13.
17	if D equals a number between 1 and 5 put "OGRE" into D$. If D is between 6 and 8 put "SWORD" into D$.
18	if D is greater than 9 then go to line 9.
19	print what you have found on the screen.
20	if you encounter an OGRE and you have a SWORD then go to line 28.
21 and 22	if you found SWORD put 0 into S and then go to line 9.
23 and 24	if you met OGRE and you have a SWORD then the options available are displayed and prompt for a response.
25	go to line 34 or 35 depending on the number you get from the input, entry, routine.
26	if you have not put in a response allowed by the computer go to line 35.
28—30	make S equal 0 and increase B by one for the number of battles won.
31 and 32	display a message and wait for NEW LINE.
34 and 35	depends on lines 25 and 26 and gives you a random chance of dying.
36	STOPs you as you are dead.
37	congratulations and number of battles won.
38-40	player-response entry routine used in line 12.

THE EYE



WHEN THE PROGRAM is RUN a large flickering eye is displayed on the screen and that is accompanied by a sound effect. Pressing any key will produce a flashing border and a different sound effect along with a message from Big Brother. **The Eye** is a beginners' program written for the 16K Spectrum by S Burke of Buckhurst Hill, Essex.

```
   1 REM BIG BROTHER
   2 BORDER 0: PAPER 0: PAPER 0:
 INK 6: CLS
   3 PLOT 0,100
   4 DRAW 255,0,PI/1.4
   5 DRAW -255,0,PI/1.5
   6 INK 2
   7 PLOT 80,45: DRAW 100,100,55
6
   8 FOR z=65 TO 1 STEP -1
   9 IF INKEY$<>"" THEN  GO SUB
100
  10 LET x=RND*10
  11 LET Y=RND*10
  12 BEEP .003,Z
  13 INK RND*7: PLOT 128+X,82+Y
  14 NEXT Z
  15 GO TO 8
 100 PRINT #0; FLASH 1;"    SMILE
   B I G    B R O T H E R    IS
WATCHING    YOU    "
 101 FOR L=1 TO 80: OUT 254,0: O
UT 254,255: NEXT L
 102 INPUT INKEY$
 103 RETURN
```



SHOOT THE NUMBER

YOU MUST SHOOT the numbers as they move up the screen. The numbers are mixed with letters and if you hit a letter by mistake or if you miss a number the game will end. You are then told how long you lasted. **Shoot The Number** was written for the 1K ZX-81 by John Gregory of Preston, Lancs.

```
   1 LET S=0
   9 SCROLL
  10 LET X=INT (RND*20)+28
  11 PRINT AT 21,10;CHR$ X
  15 PRINT AT 10,0;"x";AT 10,0;C
HR$ ((S-S)*S)
  16 IF INKEY$<>"" THEN GOTO 20
  17 GOTO 9
  21 PRINT AT 10,1;"**********";A
T 10,1;"          "
  22 PRINT AT 10,10;
  23 IF PEEK (PEEK 16398+256*PEE
K 16399)<38 THEN GOTO 30
  24 PRINT AT 0,0;"SCORE=";S;Q
  30 LET S=S+1
  31 GOTO 9
```

Trapping the errors will ensure first-time running

THE FIRST error code encountered by most Sinclair users is the flashing "S" on the ZX-81 or "?" on the Spectrum, which indicates a syntax error in a sentence. Experience and the manual soon show that it is caused usually by typing-in a keyword letter by letter, or by bad punctuation, for example omitting a semi-colon or an inverted comma.

The most frequently-occurring error code is "2" — variable not found. A variable is a letter which has been given a numeric value. When you enter "LET a=2" you are defining a variable. Error code 2 results when the computer reaches a variable in the program to which you have so far given no value.

Check the line which the computer specifies. If it is your program, give a value to the variable or remove it. If you are copying the program, look back in the listing to see which line you have missed.

Although the majority of error codes are explained adequately in the manuals, the report "B-Integer out of range" can be confusing. An integer is a whole number — 1 is an integer, 1.5 and 1½ are not. That code occurs most frequently when you try to print something beyond the limits of the screen.

PRINT AT 0,31; "a" is acceptable and will print a letter "a" at the top right of the screen. PRINT AT 0,32; "a" would not be possible. The integer 32 would be out of range, resulting in error code "B". That would also happen if the computer were instructed to PRINT AT 0,31;"ab". It would still be trying to print a character beyond the limits of the screen.

That error is more difficult to detect if variables have been used as co-ordinates and your character, or series of characters, is being printed in varying positions. If the instruction PRINT AT 0,x;"a" produces report code B, make sure that the value of x never increases beyond 31.

On the Spectrum "B-integer out of range" is also often found when you are POKEing-in user defined graphics. The biggest number which can be POKEd-in this case is 255 or BIN 11111111. In that case the error code will occur in the line containing the POKE statement. In most cases, though, the error will have occurred in one of the DATA lines in the program.

A very frequent error code produced on the Spectrum is "E-Out Of Data". That will occur in a line containing a READ statement. The error code, though, will have occurred in one of the program DATA lines, which may be nowhere near the READ line. A READ command sends the computer to a DATA line to collect the next piece of DATA contained there. That is often done using a FOR, NEXT loop, especially when graphics are being set up.

FOR n=1 TO 8: READ n will send the computer to the DATA lines eight times, for eight separate pieces of information. If there are only seven pieces of DATA there it will return to the READ line and produce the code OUT OF DATA. When there are several DATA lines they will all have to be checked, because the piece of DATA you have omitted was not necessarily the last.

In some cases the computer will follow the program correctly, without producing an error code, but from the programmer's point of view the program contains an error. In that case BREAK into the program at the moment it goes wrong. That will produce report code 9 and the line on which you have STOPped the program. That method makes it easy to locate the area of the program which contains the error.

Programs which you copy from magazines, books or from friends can be difficult to error-trap because they contain programming techniques which you have not yet learned, or simply because it is often difficult to follow another programmer's logic.

The flashing "S" or "?" indicating a syntax error may appear frequently. In that case check carefully what you have copied. You may not have recognised words such as LN or EXP as keywords.

On the ZX-81 especially it is easy to forget that pressing "π" will produce the word PI.

Make sure that when the "is not equal" sign, "<>" appears in a listing you always enter it as one character and not as "is less than", "<" followed by "is greater than", ">".

Technical problems can also cause errors in programs. Any alteration to the power supply can cause a program to CRASH. In that case the screen display may change dramatically and using the keyboard will have no effect. The only solution is to unplug your computer and begin again, making sure that your power supply and RAM pack are both connected firmly. That error is caused by the computer and not by the program.

> 'The error need not be on the line which produces the report; that is simply the line where the computer meets the problem'

Sometimes a program listing in a book or magazine will contain what seems to be a very obvious error. If it contains key words or symbols which are not on your computer, check that it is intended for your machine. Programs for the Spectrum, the ZX-81 and the ZX-80 are not usually directly interchangeable. If a program contains the command GOTO or GOSUB — a non-existent line number — the computer will simply go to the next numbered line after that one. That is a sign that a program has been developed and improved and is rarely an error.

When you have errors in a program, first check the report codes listed in Appendix B of the manual. It may then be necessary to read the appropriate section of the manual. Remember that the error is not necessarily on the line which produces the report code; that is simply the line where the computer meets the problem for the first time.

Always check carefully every line connected with the line containing the error code and the mistake should be easy to locate.

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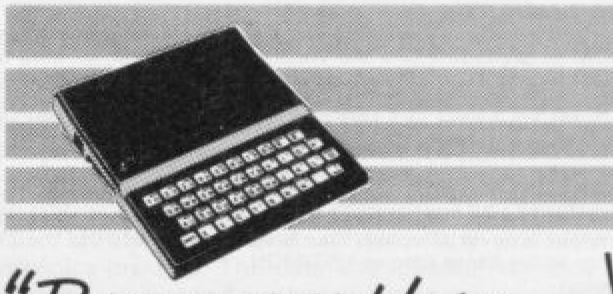
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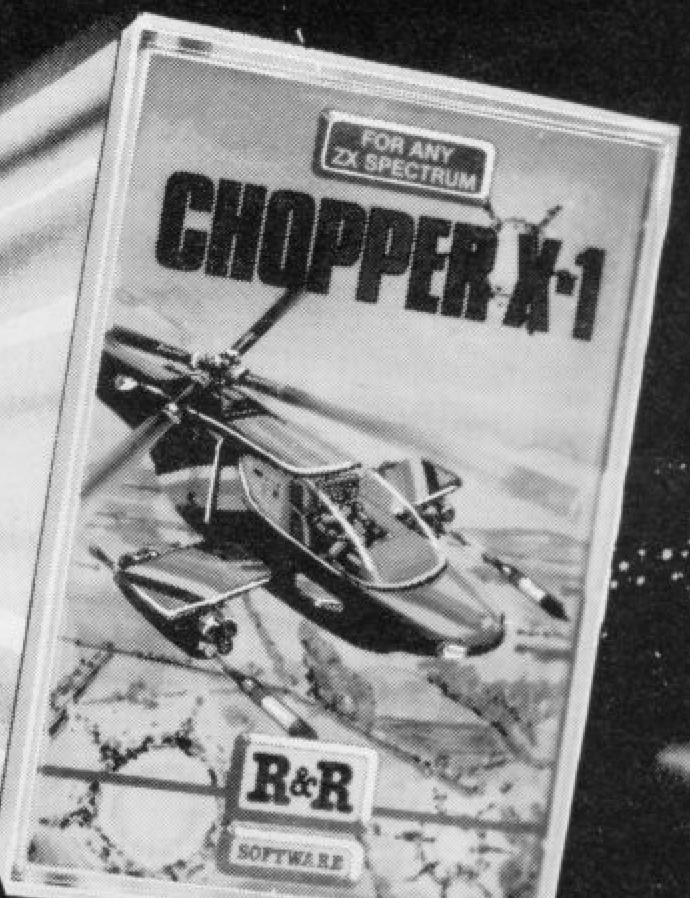
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ZX equivalents

Andrew Hewson explains how you can convert your programs to run on a different machine

PROBLEMS of converting programs written to run on one machine so that they run correctly on another are the subject of a number of queries. Correspondents who have raised the topic include Shawn Woodhouse of Harrogate, Chris Fowler of Sheffield, and Glen Lewis of Walthamstow. Most requests concern the conversion of ZX-81 programs to run on the Spectrum but Fowler in particular asked for details on the conversion of ZX-80 programs.

Sinclair Basic is not upwards-compatible, i.e., it is not necessarily possible to transfer a program written for the ZX-80 on to the ZX-81 or Spectrum. Usually, however, only a relatively small number of alterations is required. The converse is not true, because generally a program written for a more sophisticated machine will use facilities which are not present and cannot be emulated on a predecessor. Thus I have assumed readers are interested either in converting ZX-80 programs to run on the ZX-81 or converting ZX-81 programs to run on the Spectrum.

ZX-80 Code	Character	ZX-81 Code	ZX-80 Code	Character	ZX-81 Code
0	space	0	148	inverse *	151
1	space	11	149	inverse /	152
2	graphics	5	150	inverse =	148
3	graphics	131	151	inverse >	146
4	graphics	1	152	inverse <	147
5	graphics	2	153	inverse ;	153
6	graphics	4	154	inverse ,	154
7	graphics	135	155	inverse .	155
8	graphics	6	212	"	11
9	graphics	8	213	THEN	222
10	graphics	9	214	TO	223
11	graphics	10	215	;	25
12	£	12	216	,	26
13	$	13	217	)	17
14	:	14	218	(	16
15	?	15	219	NOT	215
16	(	16	220	—	22
17	)	17	221	+	21
18	—	22	222	*	23
19	+	21	223	/	24
20	*	23	224	AND	218
21	/	24	225	OR	217
22	=	20	226	**	216
23	>	18	227	=	20
24	<	19	228	>	18
25	;	25	229	<	19
26	,	26	230	LIST	240
27	.	27	231	RETURN	254
128	graphics	128	232	CLS	251
129	inverse "	139	233	DIM	233
130	graphics	133	234	SAVE	248
131	graphics	3	235	FOR	235
132	graphics	129	236	GOTO	236
133	graphics	130	237	POKE	244
134	graphics	132	238	INPUT	238
135	graphics	7	239	RAND	249
136	graphics	134	240	LET	241
137	graphics	136	243	NEXT	243
138	graphics	137	244	PRINT	245
139	graphics	138	246	NEW	230
140	inverse £	140	247	RUN	247
141	inverse $	141	248	STOP	227
142	inverse :	142	249	CONT	232
143	inverse ?	143	250	IF	250
144	inverse (	144	251	GOSUB	237
145	inverse)	145	252	LOAD	239
146	inverse −	150	253	CLEAR	253
147	inverse +	149	254	REM	234

Table 1. A list of ZX-80 character codes and their ZX-81 equivalents.

All the software facilities available on the ZX-80 can be mimiced on the ZX-81 but the latter machine is less economical of memory space as a consequence of its greater sophistication. For example:

The ZX-81 use 85 bytes more in the systems variables area; the ZX-81 requires five bytes to hold the value of a variable, thus permitting the use of non-integer numbers, compared to the two bytes used by the integer-only ZX-80. A calculator stack therefore is required; constants in a ZX-81 program are held both in their character and in their numeric form so that an extra six bytes per constant are required; two bytes per program line are used by the ZX-81 to hold the line length.

There is no equivalent usage by the ZX-80. Hence it will often be necessary to prune a 1K ZX-80 program to load it into a ZX-81.

All ZX-80 commands and functions have exact counterparts on the ZX-81 except for the TL$ function, the DIM command, the division operator and the RND function. These are dealt with as follows:

The TL$ function is a special case of the ZX-81 slicing facility and is replaced by (2 TO). For example:

LET A$=TL$ (A$) becomes LET A$=A$ (2 TO).

Array indices start at 0 on the ZX-80 and 1 on the ZX-81 so that

```
DIM B(5)
PRINT B(0)
```

is meaningful only on the ZX-80. Hence one is added to every array subscript.

Numbers are converted to integers explicitly on the ZX-81 using the INT function before division. For example:

```
LET B=B/5 becomes
LET B=INT (B)/5
```

The ZX-80 random number function RND (N) generates a random integer between 1 and N inclusive, whereas on the ZX-81 RND generates a random



• *Please address problems and queries to Andrew Hewson, Helpline, Graham Close, Blewbury, Oxfordshire.*

number in the range 0 to 1. Thus, for example:

LET A=RND (N) becomes
LET A=1+INT (N * RND)

The character codes used by the ZX-81 are listed in appendix A of the operating manual. The codes for both letters and numbers in both normal and inverse video are the same as those used by the ZX-80 but the remainder are mostly different. Table one lists the ZX-81 equivalents for the non-alphabetic or numeric codes used by the ZX-80. Reference should be made to the table when converting CHR$ or CODE commands.

The ZX-80 uses fewer system variables than the ZX-81 and most of them have direct equivalents as listed in table two. Note that the variables area occurs below the display file in the ZX-80 but above it in the ZX-81 and so conversion of a program which manipulates the VARS, D-FILE and DF-CC variables is particularly difficult.

ZX-80 address	No. of bytes	ZX-81 address	ZX-81 name
16384	1	16384	ERR-NR
16385	1		
16386	2	16391	PPC
16388	2		
16390	2	16394	E-PPC
16392	2	16400	VARS
16394	2	16404	E-LINE
16396	2	16396	D-FILE
16398	2	16398	DF-CC
16400	2	16400	VARS
16402	1	16418	DF-SZ
16403	2		
16405	2	16408	X-PTR
16407	2	16427	OLDPPC
16409	1		
16410	2	16432	T-ADDR
16412	2	16434	SEED
16414	2	16436	FRAMES
16416	2		
16418	2		
16420	1	16441	S-POSN
16421	1	16442	
16422	2		

Table 2. ZX-80 system variables and their ZX-81 equivalents.

On the ZX-80 the FRAMES counter is incremented 50 times per second, whereas on the ZX-81 it is decremented, except bit 15, and that difference should be taken into account during program conversion.

Just as the ZX-81 uses more RAM space than the ZX-80, so, in turn, the Spectrum uses more than the ZX-81. The principal reason is the high-resolution Spectrum display which uses 6,912 of the 16,384 bytes in RAM in the 16K Spectrum, compared to 792 bytes used by the 16K ZX-81. So it is unlikely that a full-size 16K ZX-81 program can be adapted to run in a 16K Spectrum.

Table three lists the ZX-81 character codes which have a direct Spectrum equivalent. In a few cases the character is different, although the function is the same, in which case both versions are shown in the table. For example, the exponentiation operator is ** on the ZX-81 — code 216 — and ∧ on the Spectrum — code 94.

Much of the software which runs the calculator in the Spectrum has been copied straight from the ZX-81 and that is reflected in the manner in which the character codes in the two machines, although dissimilar, march in step. The ZX-81 codes for AT, TAB, CODE through to NOT are all 21 more than the codes for the same characters on the Spectrum. It is intriguing to note that the VAL$ function, which is present on the Spectrum — code 174 — but is not present on the ZX-81 logically would have had a ZX-81 code of 195, a code which is "not used" according to appendix A of the ZX-81 manual.

Bearing in mind that the ZX-81 was designed and built long before the Spectrum, the implication is that Sinclair intended that the ZX-81 should have a VAL$ function but it was omitted at the last minute.

Six half-tone graphics characters in the ZX-81 do not appear in the Spectrum character set but it is a straightforward matter to create user-defined characters as required. The data for each of the characters is listed in table form. Five more ZX-81 characters have no Spectrum equivalent:

116 Graphics command
120 K/L mode toggle
127 Cursor
228 SLOW
229 FAST

It is unlikely that any of the first three would be used explicitly in a program and so no substitute is given. The FAST command turns the ZX-81 display, speeding program execution by a factor of about four and the SLOW command turns it on again. Those commands can almost always be omitted when a program is transferred to the Spectrum, except when the FAST command has been included to prevent the user inspecting the display, in which case CLS can be substituted.

Finally, there are four characters which require special substitutes. They are """" — the paired double quotes character — SCROLL, PLOT and UNPLOT. They are dealt with as follows:

The paired double quotes character, which denotes a string within a string,

'Usually only a small number of alterations is required"

is replaced by two successive double quotes characters.

The SCROLL command, which moves the display up by one line, is replaced by INPUT;.

PLOT X,Y is replaced by PLOT 4*X+2, 4*Y+2. The latter is not identical because the Spectrum pixel size is much smaller and the point will appear slightly off-centre but the difference is unlikely to be important.

UNPLOT X,Y is replaced by PLOT INVERSE 1; 4*X+2, 4*Y+2.

Table five lists the ZX-81 system variables and the Spectrum equivalents. There are several points to be noted:

The ZX-81 system variable D-FILE at 16396 which points to the beginning of the display file has no Spectrum equivalent, because the Spectrum display lies at the bottom of RAM at address 16384.

The FRAMES counter is two bytes long on the ZX-81 — and bits 0 to 14

continued on page 124

ZX-81 graphics code	Spectrum user-defined graphic equivalent
8	170,85,170,85,170,85,170,85
9	0,0,0,0,170,85,170,85
10	170,85,170,85,0,0,0,0
136	85,170,85,170,85,170,85,170
137	255,255,255,255,85,170,85,170
138	85,170,85,170,255,255,255,255

Table 3. Definitions of Spectrum UDG characters for ZX-81 graphics characters not present in the standard Spectrum character set.

ZX-81 code	Character	Spectrum code	ZX-81 code	Character	Spectrum code
0	space	32 or 128	118	NEWLINE/ENTER	13
1	graphics	130	119	RUBOUT/DELETE	12
2	graphics	129	126	number	14
3	graphics	131	128	graphics	143
4	graphics	136	129	graphics	141
5	graphics	138	130	graphics	142
6	graphics	137	131	graphics	140
7	graphics	139	132	graphics	135
11	"	34	133	graphics	133
12	£	96	134	graphics	134
13	$	36	135	graphics	132
14	:	58	193	AT	172
15	?	63	194	TAB	173
16	(	40	196	CODE	175
17	)	41	197	VAL	176
18	>	62	198	LEN	177
19	<	60	199	SIN	178
20	=	61	200	COS	179
21	+	43	201	TAN	180
22	−	45	202	ASN	181
23	*	42	203	ACS	182
24	/	47	204	ATN	183
25	;	59	205	LN	184
26	,	44	206	EXP	185
27	.	46	207	INT	186
28	0	48	208	SQR	187
29	1	49	209	SGN	188
30	2	50	210	ABS	189
31	3	51	211	PEEK	190
32	4	52	212	USR	192
33	5	53	213	STR $	193
34	6	54	214	CHR $	194
35	7	55	215	NOT	195
36	8	56	216	** / ∧	94
37	9	57	217	OR	197
38	A	65	218	AND	198
39	B	66	219	< =	199
40	C	67	220	> =	200
41	D	68	221	< >	201
42	E	69	222	THEN	203
43	F	70	223	TO	204
44	G	71	224	STEP	205
45	H	72	225	LPRINT	224
46	I	73	226	LLIST	225
47	J	74	227	STOP	226
48	K	75	230	NEW	230
49	L	76	232	CONT/CONTINUE	232
50	M	77	233	DIM	233
51	N	78	234	REM	234
52	O	79	235	FOR	235
53	P	80	236	GOTO/GO TO	236
54	Q	81	237	GOSUB	237
55	R	82	238	INPUT	238
56	S	83	239	LOAD	239
57	T	84	240	LIST	240
58	U	85	241	LET	241
59	V	86	242	PAUSE	242
60	W	87	243	NEXT	243
61	X	88	244	POKE	244
62	Y	89	245	PRINT	245
63	Z	90	247	RUN	247
64	RND	165	248	SAVE	248
65	INKEY$	166	249	RAND/ RANDOMIZE	249
66	PI	167			
112	cursor up	11	250	IF	250
113	cursor down	12	251	CLS	251
114	cursor left	8	253	CLEAR	253
115	cursor right	9	254	RETURN	254
117	EDIT	7	255	COPY	255

Table 4. ZX-81 character codes and their Spectrum equivalents.

continued from page 123

only are used — and three bytes long on the Spectrum.

The COORDS variables are different, reflecting the difference in the PLOT resolution in the two machines.

The ZX-81 printer buffer, PRBUFF, is 33 bytes long and lies within the system variables area starting at address 16444. The Spectrum printer buffer is 256 bytes long, so that it can hold high-resolution characters, and lies below the systems variables area.

'It is essential to understand the function of the code'

A word of warning. It is not possible to guarantee that a given program can be transferred from one machine to its successor. If the program author has made use of PEEKs or POKEs, it is essential to understand the function of his code on the original machine before designing the equivalent to run elsewhere. Usually that means entering the code into the first machine and analysing it dynamically.

ZX-81 address	No. of bytes	Spectrum address	Spectrum name
16384	1	23610	ERR NR
16386	2	23613	ERR SP
16388	2	23730	RAMTOP
16390	1	23617	MODE
16391	2	23621	PPC
16394	2	23625	E PPC
16396	2		
16398	2	23684	DF CC
16400	2	23627	VARS
16402	2	23629	DEST
16404	2	23641	E LINE
16406	2	23645	CH ADD
16408	2	23647	X PTR
16410	2	23650	STKBOT
16412	2	23653	STKEND
16414	1	23655	BREG
16415	2	23656	MEM
16418	1	23659	DF SZ
16419	2	23660	S TOP
16421	2	23560	LAST K
16423	1	23552	KSTATE
16425	2	23637	NXTLIN
16427	2	23662	OLDPPC
16430	2	23666	STRLEN
16432	2	23668	T ADDR
16434	2	23670	SEED
16436	2	23672	FRAMES
16438	1	23677	COORDS
16439	1	23678	COORDS
16440	1	23680	PR CC
16441	1	23688	S POSN (col)
16442	1	23689	S POSN (lin)
16444	22	23296	PRBUFF
16477	30	23698	MEMBOT

Table 5. ZX-81 system variables and their Spectrum equivalents.

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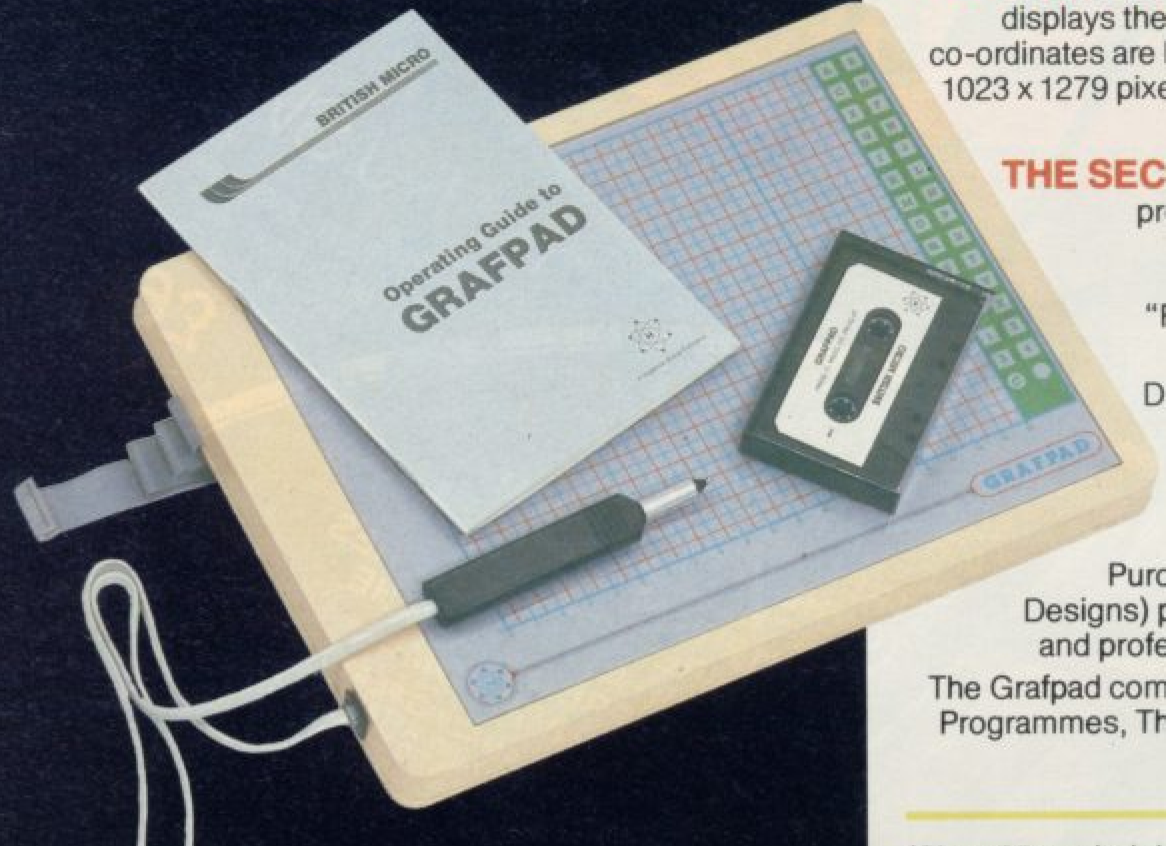
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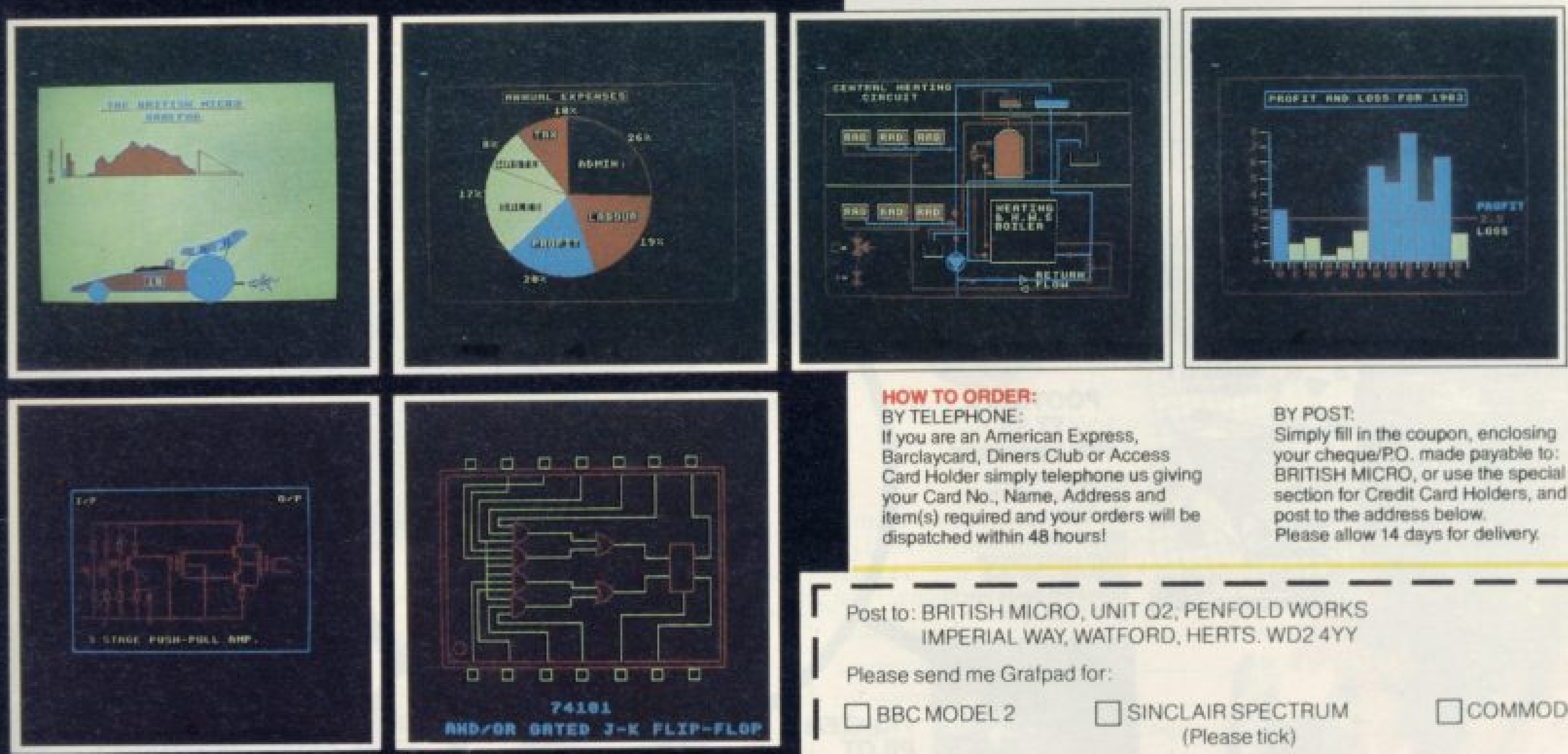
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Powerful pull of the evil timelords

Quentin Heath finds that classic text-only adventures can still hold their own

SOME PEOPLE may wonder where the good old text-only adventure games, such as those from Artic Computing, have gone. The advance of graphics and animated adventures, as explored in Mind Games in February, seem to have overshadowed this type of game.

Melbourne House started the move towards this type of game with **The Hobbit** last year and since then it has continued with the serious, from companies such as Digital Fantasia and Carnell, to the silly, from Automata with its **Pi-man** and **Uncle Groucho.**

Most of those graphics adventures are entertaining and worth the money but the textual adventure still holds a formidable place in the market. That is because, with graphics excluded, there is more memory with which to produce complicated plots. Having no graphics facilities also makes the author concentrate on conveying the atmosphere of an adventure to the player and using psychological tricks to beguile the unwary adventurer.

A good example of the state of the art in textual adventures is **Lords of Time,** the first part of a saga of the same name, from Level Nine Computing. It also shows what can be achieved by somebody who has been designing computer games for only a few months.

Lords of Time, for the 48K Spectrum, is about a band of evil Timelords, with no connection with Dr Who, who want to warp the course of Earth's history. To defeat their evil aims the player must travel through time to collect nine objects which will, if used correctly, restore the flow of time to its correct path.

You will receive your mission instructions from Father Time, if you can discover his whereabouts. Finding him is a matter of elimination, as he will convey his message to you through the only item which has nothing to do with time, or is timeless. It might help you to look upon him as a figure such as Dorian Gray, or Alice.

It is a good idea to pick up any objects you may find during your quest. At first you may have difficulty collecting all the items you need, as you can carry only a few items in your hands at one time. A pack on your back might help but you will soon realise that you need to act like a magpie and find a nest into which you can put the objects until you need them. The pack will not count as an object and you should find it at the end of a country lane.

Unlike the unfortunate Dr Who, you will have some control over your time machine.

The author provides you with nine cogs which make up a wheel of time. If you can learn to control them you should be able to land in any of the nine time zones you desire. It is, however, best to start in time zone one as you will find objects and tests which will be important when you reach the higher time zones.



It would be useful to make a map but, because of the complexity of the game, it is better to produce a plan for each time zone, together with a page of notes for each of those subsections of the adventure than to try to produce one overall plan. Some kind of plan is needed if you are to take this adventure seriously, as each time zone is like a mini adventure in its own right.

One of the most intriguing and helpful aspects is that you can learn by your mistakes better than in most other adventures with which I have dealt in this column. It is helpful to be killed by the giant Mammoth or Allosaurus in the pre-historic time period, as it will show you how to react, and what is expected in the way of weapons the next time you encounter either of those fearsome beasts.

I will endeavour to give some more clues to the solution of this mystery in Hints and Tips but it would take several months to give clues to them all.

The complexity of the plot is achieved partly by the data compilation and compression techniques used by Level Nine Computing in programming its games. That means that, to some extent, the bounds of memory availability become less important as data is squeezed into the memory available. Measuring information in the number of bytes or kilobytes it could, for instance, be possible to store 60K of data in only 40K, which is all you would have on a 48K Spectrum.

It is difficult to chart progress but as a general hint the timescape is structured so that you start when the earth was young, in the Ice Age, continue through Roman and Viking times, go through mediaeval and Tudor history and arrive in the present in a fairly battered state. The adventure does not finish in the present, however, as you will have to visit the near and far future to battle the Lords of Time.

If you know something about ancient history or archaeology you may be able to find your way round the adventure better than the player who knows little of house design during the Roman occupation of Britain.

The designer of both the plot and scenarios spent many months researching the finer points of scenic description with reference to such locations as Roman villages. The research was so deep that many of the locations are from descriptions of real places. The descriptions are so powerful in some cases that you can picture the locations without difficulty.

Level Nine Computing is one of the only companies I know which provides a back-up service for its adventurers. If you have difficulty with any part of the adventure you can send for a clue, using an envelope which has Fly back with a clue printed on it.

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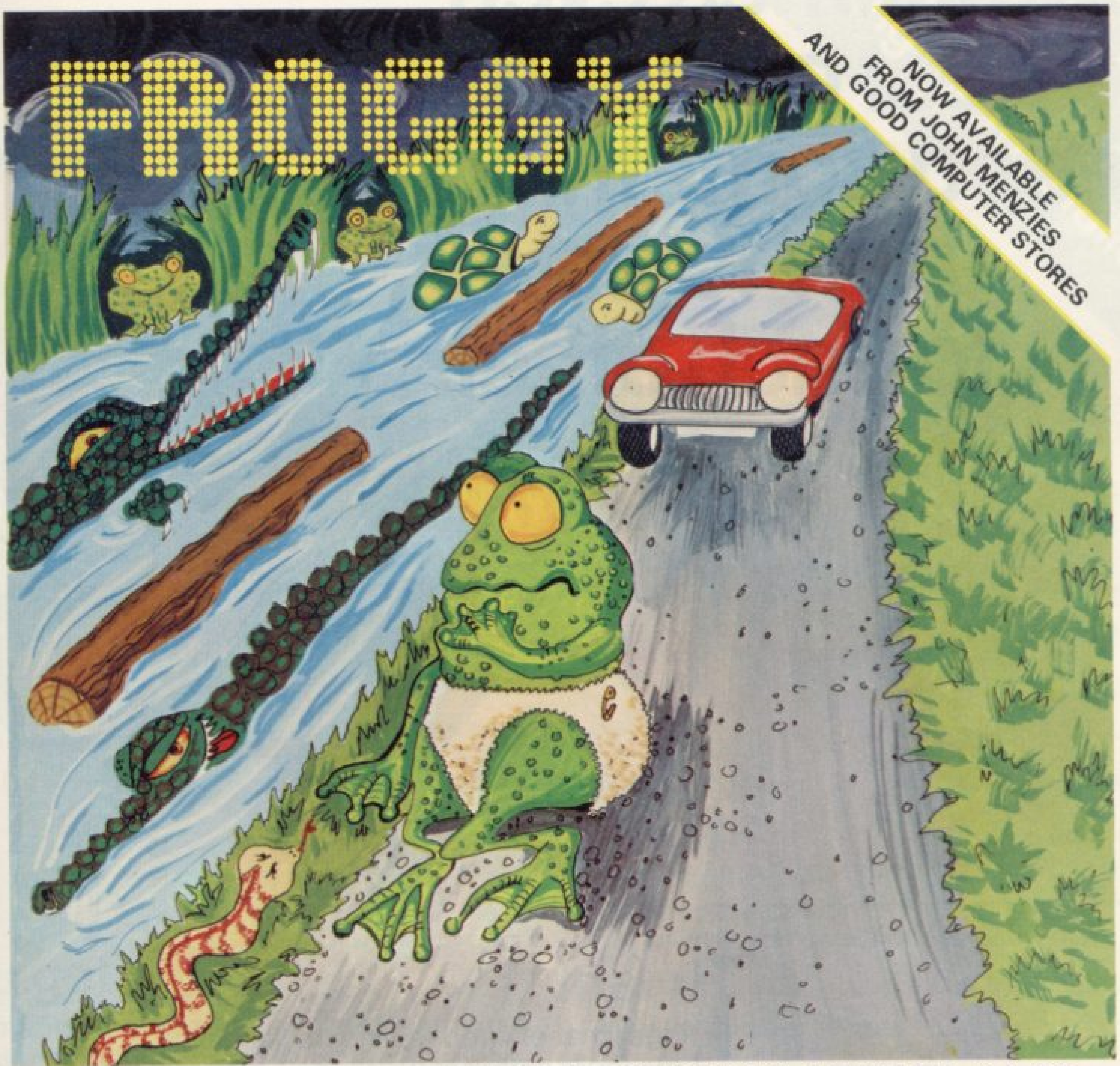
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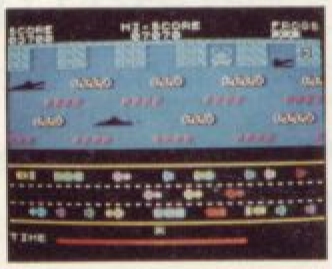
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Accounts (Limited Company)	48K Spec.	Hestacrest	Business	*
Accounts (Sole Trader)	16K ZX-81	Hestacrest	Business	*
Accounts (Sole Trader)	48K Spec.	Hestacrest	Business	*
Ace in the Hole	48K Spec.	Add-on	Adventure	*
Address File	48K Spec.	SD Micro	Business	*
Address Manager	48K Spec.	OCP	Business	7
Adven. St. Bernard	48K Spec.	Carnell	Arcade	7
Adventure 1	16K ZX-81	Abersoft	Adventure	6
Adventure 1	48K Spec.	Abersoft	Adventure	6
Adventure Isl.	48K Spec.	Contrast	Adventure	*
Air Traffic Controller	16K Spec.	Hewson	Sim.	6
Airline	16K ZX-81	CCS	Sim.	7
Airline	48K Spec.	CCS	Sim.	7
Airliner	16K Spec.	Protek	Sim.	6
Alchemist	48K Spec.	Imagine	Adventure	*
Alien Dropout	16K ZX-81	Silversoft	Arcade	*
Allsort S-1	48K Spec.	A Firminger	Utility	7
Alphabet	16K Spec.	Widget	Education	*
Alphabet Games	16K Spec.	Sinclair	Education	*
Android One	16K Spec.	Vortex	Adventure	*
Android Two	48K Spec.	Vortex	Arcade	*
Ant Attack	48K Spec.	QS	Arcade	8
Apocalypse	48K Spec.	Red Shift	Mind Game	*
Apostrophe	16K Spec.	Sinclair	Education	7
Aquarius	16K Spec.	Bug-Byte	Arcade	6
Arcadia	16K Spec.	Imagine	Arcade	5
Arcadian	16K Spec.	J K Greye	Arcade	6
Arcane Quest	48K Spec.	Add-on	Adventure	*
Armageddon	48K Spec.	Silversoft	Arcade	*
Aspect	16K Spec.	Bug Byte	Utility	5
Assassin	16K Spec.	Spectrasoft	Arcade	*
Assembler	48K Spec.	Artic	Utility	6
Asteroids	16K ZX-81	Silversoft	Arcade	8
Asteroids	16K ZX-81	Software Farm	Arcade	6
Astral Convoy	16K ZX-81	Vortex	Arcade	*
Atic Atac	48K Spec.	Ultimate	Arcade	8
Attack on New York	16K Spec.	Fry	Arcade	*
Audio Sonics	16K Spec.	Work Force	Utility	4
Auto Chef	16K Spec.	CCS	Sim.	*
Auto Chef	16K ZX-81	CCS	Sim.	*
Avenger	16K Spec.	Abacus	Arcade	*
Backgammon	16K Spec.	Hewson	Mind Game	*
Backgammon	48K Spec.	CP	Mind Game	7
Ballooning	16K Spec.	Heinemann	Education	*
Baltic Patrol	16K Spec.	E. Midland	Arcade	*
Bank Account Syst.	48K Spec.	K Gouldstone	Business	8
Bank Raid	16K ZX-81	J M Senior	Game	*
Bank Robber	16K ZX-81	Romik	Arcade	6
Bank Verifier	48K Spec.	SD Micro	Business	*
Baron	16K Spec.	Temptation	Arcade	*
Barrow Quest	16K ZX-81	Sherry	Adventure	*
Base Invaders	16K Spec.	Imagination	Arcade	*
Base Invaders	48K Spec.	Work Force	Arcade	6
Battle 1917	48K Spec.	CCS	Strat.	8
Battle of Britain	48K Spec.	Microgame	Strat.	*
Battleships	16K ZX-81	JRS	Strat.	*
Beamscan	48K Spec.	Beamscan	Utility	9
Bear Bovver	48K Spec.	Artic	Arcade	8
Beta Basic	16K Spec.	Betasoft	language	9
Beyond Basic	48K Spec.	Sinclair	Utility	*
Big Match Soccer	16K Spec.	Winters	Strat.	*
Biorythms/Pyramids of Egypt	16K Spec.	Spectrasoft	Game	*
Birds and Bees	48K Spec.	Bug-Byte	Arcade	8
Black Crystal	16K ZX-81	Carnell	Adventure	7
Black Crystal	48K Spec.	Carnell	Adventure	7
Black Dwarf's Lair	48K Spec.	Newsoft	Adventure	*
Black Hole	16K Spec.	Quest	Arcade	6
Black Planet	48K Spec.	Phipps	Adventure	7
Blade Alley	48K Spec.	PSS	Arcade	*
Blind Alley	16K Spec.	Sunshine	Arcade	7
Brag	48K Spec.	T Lebon	Trad.	7
Brain Damage	48K Spec.	Silversoft	Arcade	*
Breakaway	16K Spec.	Procom	Arcade	*
Brewery	48K Spec.	CCS	Strat.	8
Bridge Tutor	16K Spec.	CP	Mind Game	8
British Lowland	48K Spec.	CCS	Sim.	*
Bubble Bugs	16K ZX-81	Romik	Arcade	6
Bubble Trouble	48K Spec.	Arcade	Arcade	*
Bug Blaster	16K Spec.	Crystal Comp.	Arcade	*
Bugaboo	48K Spec.	QS	Arcade	7
Business Bank Account	16K ZX-81	Transform	Business	*
Business Bank Account	48K Spec.	Transform	Business	*
Byte	48K Spec.	CCS	Adventure	*
Byter	16K ZX-81	Protek	Arcade	*
Calpac 1-2	16K ZX-81	Calpac	Education	*
Calpac 1-3	16K Spec.	Calpac	Education	*
Car Journey	16K Spec.	Heinemann	Education	*
Cargo	16K Spec.	Sinclair	Education	*
Caribbean Trader	48K Spec.	E. Midland	Adventure	*
Caribbean Trader	48K Spec.	E. Midland	Adventure	7
Cartoon Animation	48K Spec.	Fowler	Utility	*
Cash Controller	48K Spec.	Shepherd	Business	7
Cassette 1	1K ZX-81	Orwin	Arcade	*
Cassette 2-5	16K ZX-81	Orwin	Arcade	*
Cassette A	16K Spec.	Orwin	Arcade	*
Castle Spellerous	48K Spec.	Sinclair	Education	8
Caterpillar	16K Spec.	CDS	Arcade	*
Cavernfighter	16K Spec.	Bug-Byte	Arcade	*
Centi-bug	16K Spec.	DK Tronics	Arcade	*
Challenge	16K Spec.	Temptation	Trad.	*
Character Gen	16K Spec.	Spectrasoft	Utility	*
Chequered Flag	48K Spec.	Sinclair	Arcade	8
Chess Tutor 1	48K Spec.	Sinclair	Education	*
Children's Compendium	16K Spec.	Dymond	Game	*
Chuckie Egg	48K Spec.	A & F	Arcade	8
Chuckman	48K Spec.	Add-on	Arcade	*
City Defence	16K Spec.	Mikro-Gen	Arcade	*
Collector's Pack	48K Spec.	Sinclair	Business	7
Colossal Caves	48K Spec.	CP	Adventure	8
Colour Clash	16K Spec.	Romik	Arcade	4
Compiler	48K Spec.	Softek	Utility	6
Composer	48K Spec.	Contrast	Utility	2
Conflict	16K ZX-81	Martech	Strat.	7
Conflict	48K Spec.	Martech	Strat.	*
Cookie	16K Spec.	Ultimate	Arcade	*
Corridors/Genon	48K Spec.	New Gen.	Arcade	9
Cosmic Guerilla	16K Spec.	Crystal Comp	Arcade	8
Countabout	48K Spec.	Longman	Education	*
Counting	16K Spec.	Starter Soft	Education	*
Counting	16K Spec.	Widget	Education	*
Countries of the World	16K Spec.	Hewson	Utility	8
County Cricket	48K Spec.	Allanson	Trad.	6
Creepy Crawler	16K Spec.	Mikro-Gen	Arcade	*
Crevasse and Hotfoot	16K Spec.	Microsphere	Games	7
Critical Path Analysis	16K ZX-81	Hilderbay	Business	6
Critical Path Analysis	48K Spec.	Hilderbay	Business	*
Cruise Attack	48K Spec.	Mikro-Gen	Arcade	*
Cruising	16K Spec.	Sunshine	Arcade	4
Cry Wolf!	48K Spec.	Add-on	Adventure	*
Crypt	48K Spec.	Carnell	Adventure	6
Cyber Rats	16K Spec.	Silversoft	Arcade	7
Cyber Zone	48K Spec.	Crystal Comp.	Arcade	*
Cyborg Wars	16K ZX-81	Stratagem	Strat.	7
Cycle Planner	16K Spec.	Medidata	Utility	4
Dallas	16K Spec.	CCS	Sim.	6
Dallas	16K ZX-81	CCS	Sim.	6
Database	48K Spec.	Microl	Business	7
Death Chase	16K Spec.	Micromega	Arcade	6
Deffendar	48K Spec.	Mikro-Gen	Arcade	*
Defusion	48K Spec.	Incentive	Arcade	*
Demolition	16K ZX-81	Comp. Rntls.	Game	*
Demon	48K Spec.	Micocosm	Utility	*
Demon Chase	48K Spec.	Mansfield	Arcade	4
Demon Lord	48K Spec.	MCE	Adventure	5
Derby Day	48K Spec.	Comp. Rntls.	Game	*
Designer	16K Spec.	Matrix	Utility	*
Destroyer	16K Spec.	Winters	Game	*
Detective	48K Spec.	Arcade	Adventure	7
Devil Rides In	48K Spec.	Carnell	Arcade	7
Devils of Deep	48K Spec.	Shephard	Adventure	*
Di-Lithium Lift	48K Spec.	Hewson	Arcade	*
Diamond Quest	48K Spec.	CCS	Adventure	4
Diamond Trail	48K Spec.	Gilsoft	Adventure	7

Name	Machine	Company	Type	Gilbert factor
Dictator	16K Spec.	Bug Byte	Strat.	*
Diet	48K Spec.	DK Tronics	Utility	*
Diet Master	48K Spec.	Diet Master	Utility	6
Dietician	48K Spec.	Keysoft	Utility	4
Dietron	16K Spec.	Custom	Utility	6
Digger Dan	16K Spec.	Ocean	Arcade	*
Dimension Destructors	48K Spec.	Artic	Arcade	8
Disassembler	16K Spec.	dK' Tronics	Utility	7
Display	16K Spec.	Work Force	Utility	*
DIY Book-keeping	48K Spec.	RAMTOP	Business	*
DLAN	48K Spec.	Campbell	Utility	*
Do Not Pass Go	16K ZX-81	Work Force	Strat.	*
Do Not Pass Go	48K Spec.	Work Force	Strat.	6
Dodge City	48K Spec.	Phoenix	Arcade/ adventure	7
Door Slammer	16K ZX-81	Cathedral	Arcade	7
Dr. Whom	16K ZX-81	D. Biggs	Adventure	*
Draft	16K ZX-81	Myrmidon	Business	*
Draughts	48K Spec.	CP	Mind Game	7
Dungeon Master	48K Spec.	Crystal Comp.	Adventure	8
Dungeons of Doom	16K ZX-81	Woosoft	Adventure	*
Dungeons of Doom	48K Spec.	Temptation	Adventure	*
Dymonoids	16K Spec.	Dymond	Game	*
Earth Defence	16K Spec.	Artic	Arcade	5
Editor/Assembler	16K Spec.	Picturesque	Utility	8
Education One	16K Spec.	Lerm	Education	*
Educational	16K Spec.	Startersoft	Education	*
Elektro Storm	48K Spec.	PSS	Arcade	*
Engine Diagnostic	48K Spec.	Spectrasoft	Utility	*
Escape	16K Spec.	New Generation	Maze	8
Eskimo Eddie	16K Spec.	Ocean	Arcade	*
Espionage Isl.	16K ZX-81	Artic	Adventure	*
Espionage Isl.	48K Spec.	Artic	Adventure	5
Everest Ascent	48K Spec.	Shepard	Adventure	6
Evolution	48K Spec.	Microsphere	Game	*
Ext	48K Spec.	Abbex	Arcade	6
Extended Basic	16K Spec.	CP	Utility	7
Family Games Pack	16K Spec.	Hornby	Game	*
Fantasia Diamond	48K Spec.	Hewson	Adventure	*
Farmer	16K Spec.	CCS	Sim.	*
Farmer	16K ZX-81	CCS	Sim.	*
Fighter Pilot	16K ZX-81	Digital Int.	Sim.	5
Fighter Pilot	48K Spec.	D. Integ.	Simulation	*
Finance Manager	16K Spec.	OCP	Business	9
Fireflash	16K Spec.	Abacus	Arcade	5
Firework Music	16K Spec.	Soft Cottage	Education	8
Flight Sim.	16K ZX-81	Sinclair	Sim.	6
Flight Sim.	48K Spec.	Sinclair	Sim.	6
Flippit	16K Spec.	Sinclair	Puzzle	7
Football	16K Spec.	Winters	Sim.	*
Football	48K Spec.	D. Integ.	Utility	*
Football Manager	16K ZX-81	Addictive Gms.	Sim.	*
Football Manager	48K Spec.	Addictive Gms.	Sim.	7
Football Pools Program	16K ZX-81	Hartland	Utility	*
Football Pools Program	48K Spec.	Hartland	Utility	*
The Forest	48K Spec.	Phipps	Simulation	*
Fort Apache	16K ZX-81	Contrast	Strat.	8
Forth	16K ZX-81	Sinclair	Language	7
Forth	48K Spec.	Sinclair	Language	7
Forth	48K Spec.	Melboure Hse.	Language	9
Four Rules of Number	16K Spec.	Micro Master	Education	*
Four Rules of Number	16K ZX-81	Micro Master	Education	*
FP Compiler	16/48 Spec.	Softek	Utility	9
Fred	48K Spec.	QS	Arcade	*
Freez Beez	48K Spec.	Silversoft	Arcade	*
French is Fun	48K Spec.	CDS	Education	5
French Mistress	48K Spec.	Kosmos	Education	*
French Voc Test	16K Spec.	Tutorial	Education	*
French Voc Test	48K Spec.	Tutorial	Education	*
Froggy	16K Spec.	DJL	Arcade	7
Froggy	16K ZX-81	DJL	Arcade	7
Fruit Line	16K Spec.	P A Hanson	Game	*
Fruit Machine	16K Spec.	dK' Tronics	Game	6
Full-screen Breakout	1K ZX-81	New Generation	Arcade	*
Galactians	16K Spec.	DK Tronics	Arcade	*
Galactic Trooper	16K Spec.	Romik	Arcade	3
Galactic Trooper	16K ZX-81	Romik	Arcade	6
Galactic Warriors	16K Spec.	Abacus	Arcade	6
Galaxians	16K Spec.	Artic	Arcade	6
Galaxy Attack	48K Spec.	Sunshine	Arcade	4
Galaxy Conflict	16K Zx-81	Martech	Strat.	8
Galaxy Conflict	48K Spec.	Martech	Strat.	*
Galaxy Jailbreak	16K ZX-81	Romik	Arcade	6
Gambling Tape	16K Spec.	Dymond	Game	*
Games	16K ZX-81	P Teakle	Game	*
Games 2	16K ZX-81	JRS	Game	*
Games Designer	48K Spec.	QS	Utility	7
Games Pack 1	16K Spec.	A Burnham	Game	*
Games Tape 1	1K ZX-81	J K Greye	Game	*

Name	Machine	Company	Type	Gilbert factor
Games Tape 1-2	16K Spec.	Sospan	Game	*
Games Tape 2	16K ZX-81	J K Greye	Game	*
Games Tape 3	16K ZX-81	J K Greye	Game	*
Gangsters	48K Spec.	CCS	Strat.	8
General Election	48K Spec.	Bug-Byte	Sim.	1
German Master	48K Spec.	Kosmos	Education	*
Ghost Hunt	16K Spec.	PSS	Arcade	*
Gnasher	16K Spec.	R & R	Maze	8
Go To Jail	48K Spec.	Automata	Trad.	*
Gobble-a-Ghost	16K Spec.	CDS	Arcade	*
Gobbleman	16K Spec.	Artic	Arcade	*
Gobbleman	16K Zx-81	Artic	Arcade	*
Gobbler	16K ZX-81	Software Farm	Arcade	*
Godzilla and Martians	16K Spec.	Temptation	Arcade	7
Golden Apple	48K Spec.	Artic	Adventure	7
Golf	16K Spec.	R & R	Sim.	7
Golf	16K Spec.	Virgin	Sim.	8
Golf	48K Spec.	DK Tronics	Sim.	*
Gorgon	48K Spec.	Phipps	Adventure	*
Gorilla	16K Spec.	D Hornsby	Game	*
Grand Prix	16K ZX-81	dK' Tronics	Arcade	*
Graphics	16K ZX-81	IPA	Utility	*
Graphics Toolkit	16K ZX-81	JRS	Utility	9
Great Britain Ltd	16K ZX-81	Hessel	Strat.	*
Great Britain Ltd	48K Spec.	Hessel	Strat.	7
Greedy Gulch	16K ZX-81	Phipps	Adventure	7
Grid run/Pontoon	48K Spec.	Arcade	Trad./Arcade	*
Ground Attack	16K Spec.	Silversoft	Arcade	6
Ground Force Zero	16K Spec.	Titan	Arcade	*
Guitar Tutor 1	48K Spec.	Harlequin	Education	*
Guitar Tutor 2	48K Spec.	Harlequin	Education	*
Gulp 2	16K ZX-81	Campbell	Arcade	*
Gulpman	16K Spec.	Campbell	Arcade	*
Halls of Things	48K Spec.	Crystal Comp.	Adventure	9
Handwriting	48K Spec.	Chalksoft	Education	*
Hang Glider	16K ZX-81	S Electronics	Arcade	6
Hanoi King	48K Spec.	Contrast	Mind Game	*
Haunted Hedges	16K Spec.	Micromega	Arcade	6
Heathrow	16K Spec.	Hewson	Sim.	8
Hidden Letters	16K Spec.	Poppy	Education	*
High Noon	48K Spec.	Work Force	Arcade	9
High-resolution Invaders	16K ZX-81	Odyssey	Arcade	*
Hobbit	48K Spec.	Sin/M.Hse.	Adventure	9
Hole	48K Spec.	Add-on	Adventure	*
Home Computer Pack	16K Spec.	SD Micro	Bus.	*
Hopper	16K Spec.	PSS	Arcade	6
Horace and the Spiders	16K Spec.	Sinclair	Arcade	8
Horace Goes Skiing	16K Spec.	Sinclair	Arcade	8
Horror Atoll	48K Spec.	Add-on	Adventure	*
Hot Dot Spotter	16K Spec.	Longman	Education	*
Hse. Living Dead	48K Spec.	Phipps	Arcade	*
Hunchback	48K Spec.	Ocean	Arcade	*
Hungry Horace	16K Spec.	Sinclair	Arcade	8
Hunter Killer	48K Spec.	Protek	Strat.	9
I Ching	48K Spec.	Sirius	Game	*
I Ching	48K Spec.	Salamander	Utility	7
Inca Curse	16K ZX-81	Sinclair	Adventure	*
Inca Curse	48K Spec.	Sinclair	Adventure	6
Inkos	48K Spec.	Chalksoft	Sim.	*
Integration	16K Spec.	University	Utility	8
Integration	16K ZX-81	University	Utility	8
Intermediate English 1-2	16K Spec.	Rose	Education	*
Intermediate English 1-2	16K ZX-81	Rose	Education	*
Intermediate Maths 1-2	16K Spec.	Rose	Education	*
Intermediate Maths 1-2	16K ZX-81	Rose	Education	*
Invaders	16K ZX-81	Abersoft	Arcade	*
Invaders	16K ZX-81	Bug Byte	Arcade	*
Invaders	16K ZX-81	Silversoft	Arcade	*
Invaders	16K ZX-81	Odyssey	Arcade	8
Invaders	1K ZX-81	Selec	Arcade	7
Invasion Body Snatch.	48K Spec.	Crystal	Arcade	9
Invasion Force	16K Spec.	Artic	Arcade	8
Invincible Isl.	48K Spec.	Shephard	Adventure	8
Island	48K Spec.	Crystal	Adventure	4
Island	48K Spec.	Virgin	Adventure	7
Jackpot	48K Spec.	Comp. Rntls.	Arcade	*
Jericho Road	48K Spec.	Shards	Adventure	*
Jet Pac	48K Spec.	Ultimate	Arcade	8
Jogger	16K Spec.	Severn	Arcade	*
Johnny Reb	48K Spec.	Lothlorian	Sim.	*
Jumbly	48K Spec.	D K Tronics	Quiz	*
Jungle Adventure	48K Spec.	CCS	Adventure	4
Keysounder	16K Spec.	S and G	Utility	*
King Arthur	48K Spec.	E. Midland	Simulation	*
Knight Rider	48K Spec.	Hewson	Arcade	*
Knight's Quest	16K ZX-81	Phipps	Adventure	*
Knight's Quest	48K Spec.	Phipps	Adventure	6
Krazy Kong	16K ZX-81 48K Spec.	PSS	Arcade	*

Name	Machine	Company	Type	Gilbert factor
Labyrinth	16K Spec.	Axis	Arcade	4
Language Devel. Series	16K Spec.	Glasson	Education	*
Language Devel. Series	16K Spec.	Micro Master	Education	*
Language Devel. Series	16K ZX-81	Glasson	Education	*
Language Devel. Series	16K ZX-81	Micro Master	Education	*
Las Vegas	16K Spec.	Temptation	Strat.	*
Last Sunset Lattica	48K Spec.	Arcade	Arcade	*
Lazatron	48K Spec.	Contrast	Arcade	*
Lazer Zone	48K Spec.	QS	Arcade	*
Leap Frog	16K Spec.	CDS	Arcade	*
Learn Basic	16K Spec.	Logic 3	Education	*
Learn to Read 1-5	48K Spec.	Sinclair	Education	7
Learning Read 1	16K Spec.	Poppy	Education	*
Leopard Lord	48K Spec.	Add-on	Adventure	4
Light Cycle	16K Spec.	PSS	Arcade	*
Linear Progging	16K Spec.	University	Utility	*
Linear Progging	16K ZX-81	University	Utility	*
List File	48K Spec.	SD Micro	Utility	*
Lojix	16K Spec.	Virgin	Mind Game	3
Looney Zoo	48K Spec.	Phipps	Arcade	*
Lost Island	16K ZX-81	JRS	Adventure	*
Lost Over Bermuda	48K Spec.	Add-on	Adventure	*
Luna Crabs	16K Spec.	Micromega	Arcade	7
Lunar Jetman	16K Spec.	Ultimate	Arcade	*
Machine Code Test Tool	16K Spec.	OCP	Utility	7
Machine Code Test Tool	16K ZX-81	OCP	Utility	*
Mad Martha	48K Spec.	Miko-Gen	Adventure	7
Mad Martha II	48K Spec.	Mikro-Gen	Adventure	*
Magic Meanies	16K Spec.	CDS	Arcade	2
Magic Mountain	16K ZX-81	Phipps	Adventure	*
Magnets	48K Spec.	Sinclair	Education	*
Mailing List	16K ZX-81	Hestacrest	Business	*
Make-a-Chip	48K Spec.	Sinclair	Education	*
Manic Miner	48K Spec.	Bug-Byte	Arcade	9
Mansfield Park	48K Spec.	Sussex	Education	7
Marks Book	16K Spec.	Lerm	Utility	*
Master Toolkit	16K Spec.	OCP	Utility	*
Masterfile	48K Spec.	Campbell	Business	8
Masterfile 16	16K Spec.	Campbell	Business	*
Matcalc	16K Spec.	Work Force	Utility	*
Maths Tutor	16K Spec.	AD Software	Education	*
Matrix Operations	16K Spec.	University	Utility	7
Matrix Operations	16K ZX-81	University	Utility	7
Maze Chase	16K Spec.	Hewson	Arcade	8
Maze Death Race	16K ZX-81	PSS	Arcade	*
Maze Death Race	48K Spec.	PSS	Arcade	*
Maze Man	16K ZX-81	Abersoft	Arcade	*
Maziacs	48K Spec.	dK' Tronics	Arcade	8
Mazogs	16K ZX-81	Bug Byte	Arcade	*
MCoder	16K Spec.	PSS	Utility	8
MCoder	16K ZX-81	PSS	Utility	8
Melbourne Draw	48K Spec.	Melbourne Hse.	Utility	7
Merchant of Venus	16K ZX-81	Crystal	Adventure	7
Meteor Madness	16K Spec.	Spectresoft	Arcade	*
Meteor Storm	16K Spec.	Quicksilva	Arcade	7
Meteoroids	16K Spec.	dK' Tronics	Arcade	7
Meteoroids	16K Spec.	Softek	Arcade	6
Micro Prolog	48K Spec.	Sinclair	Language	8
Micropen	16K Spec.	Contrast	Utility	*
Millypede	16K Spec.	Add-on	Arcade	7
Mined Out	16K Spec.	Quicksilva	Arcade	7
Mines of Saturn/Return to Earth	16K Spec.	Mikro-Gen	Adventure	*
Money	16K Spec.	Poppy	Education	*
Monitor/Diss.	48K Spec.	Sinclair	Utility	8
3D Monster Chase	16K Spec.	Romik	Arcade	3
Moon Alert	48K Spec.	Ocean	Arcade	*
Moon Buggy	16K Spec.	Visions	Arcade	*
Moria	16K Spec.	Severn	Adventure	*
Mountains of Ket	48K Spec.	Incentive	Adventure	8
Mr Wimpey	48K Spec.	Ocean	Arcade	7
Mr. Men	48K Spec.	Mirror	Education	*
Muncher	16K Spec.	Silversoft	Arcade	*
Muncher	16K Spec.	Silversoft	Arcade	6
Murder at Manor	48K Spec.	Gemtime	Adventure	7
Music Maker	48K Spec.	Bellflower	Utility	3
Music Master	48K Spec.	Sinclair	Education	*
Namtir Raiders	16K ZX-81	Artic	Arcade	8
Nanas	16K Spec.	Mikro-Gen	Arcade	*
Night Gunner	16K ZX-81	Digital	Sim.	5
Night Sky	16K Spec.	Bridge	Utility	*
NightFlite	16K Spec.	Hewson	Sim.	5
Nineteenth C. Eng.	48K Spec.	Sussex	Education	8
1984	48K Spec.	Incentive	Strat.	7
Nowotnik Puzzle	16K Spec.	Phipps	Game	7
Nowotnik Puzzle	16K ZX-81	Phipps	Game	*
Number 6	16K Spec.	Prime	Education	*
O Level Chemistry	16K ZX-81	Calpac	Education	*
O Level Chemistry	48K Spec.	Calpac	Education	*
O Level French Revision	16K ZX-81	Rose	Education	*
O Level Maths	16K Spec.	Homestudy	Education	*
O Level Maths Revision	16K ZX-81	Rose	Education	*

Name	Machine	Company	Type	Gilbert factor
O Level Physics	16K Spec.	Homestudy	Education	*
O Level Physics	48K Spec.	Think Tank	Education	*
Odds-on	16K Spec.	RSD	Game	*
Oligopoly	48K Spec.	CCS	Strat.	7
Omnicalc	48K Spec.	Microsphere	Business	9
Oracle's Cave	48K Spec.	Doric	Adventure	8
Orbiter	16K Spec.	Silversoft	Arcade	7
Original Superchess	16K ZX-81	CP Software	Trad.	*
Original Superchess	48K Spec.	CP Software	Trad.	*
Ostron	16K Spec.	Softek	Arcade	*
Othello	16K Spec.	CP Software	Trad.	*
Othello	16K Spec.	M.O.I.	Trad.	*
Othello	16K ZX-81	M.O.I.	Trad.	*
Party Time	48K Spec.	C. Tutor	Education	*
Pascal Compiler	48K Spec.	Hi-Soft	Language	*
Pat the Postman	48K Spec.	Mikro-Gen	Arcade	*
Pathfinder	16K Spec.	Widget	Education	*
Payroll	16K ZX-81	Hilderbay	Business	*
Payroll	32K ZX-81	Soft Tech	Business	*
Payroll	48K Spec.	Hilderbay	Business	9
Payroll	48K ZX-81	Soft Tech	Business	*
Peek	16K Spec.	Zen	Utility	*
Penetrator	48K Spec.	Mel. Hse.	Arcade	7
Pengy	16K Spec.	Micromania	Arcade	4
Personal Banking System	16K ZX-81	Hilton	Business	*
Personal Banking System	48K Spec.	Hilton	Business	*
Personal Financ. Management Syst.	48K Spec.	Fulwood	Business	*
Personal Reminder	48K Spec.	SD Micro	Utility	*
Pharoah's Tomb	16K ZX-81	Phipps	Adventure	*
Pi-Balled	48K Spec.	Automata	Arcade	7
Pi-Eyed	48K Spec.	Automata	Adventure	6
Pilot	16K ZX-81	Hewson	Sim.	7
Pimania	16K ZX-81	Automata	Sim.	*
Pimania	48K Spec.	Automata	Sim.	7
Pinball	16K Spec.	Winters	Game	*
Pirate	48K Spec.	Chalksoft	Education	*
Pitman Seven	16K Spec.	Visions	Adventure	*
Planet of Death	16K Spec.	Artic	Adventure	6
Planetoids	16K Spec.	Sinclair	Arcade	8
Plunder	48K Spec.	CCS	Strat.	8
Polynomials	16K Spec.	University	Utility	8
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Pontoon	48K Spec.	Contrast	Trad.	3
Pool	16K Spec.	Bug Byte	Game	7
Pre/early school cassettes	16K Spec.	Essex	Education	*
Primary Arithmetic	16K Spec.	Rose	Education	*
Primary Arithmetic	16K ZX-81	Rose	Education	*
Print Shop	16K Spec.	CCS	Sim.	8
Print Shop	16K ZX-81	CCS	Sim.	*
Print Utilities	16K Spec.	Sinclair	Utility	*
Pro-Golf	16K Spec.	Hornby	Game	7
Programme Enhancement Package	16K ZX-81	R and R	Utility	*
Programmer's Dream	16K Spec.	Work Force	Utility	8
Proteus	16K Spec.	Abacus	Arcade	5
Pssst	48K Spec.	Ultimate	Arcade	7
Puckman	16K ZX-81	Hewson	Arcade	*
Punctuation Pete	16K Spec.	Heinemann	Educational	*
Purchase Ledger	16K ZX-81	Hestacrest	Business	*
Pyramid	48K Spec.	Fantasy	Arcade	8
Quazar	16K Spec.	Rose	Mind Game	4
Quest	48K Spec.	Hewson	Adventure	7
Quetzalcoatl	48K Spec.	Virgin	Adventure	8
Quick Thinking	48K Spec.	Mirror	Education	*
Quill	48K Spec.	Gilsoft	Utility	9
Quincy	16K Spec.	Severn	Strat.	*
Raider Cursed Mine	48K Spec.	Arcade	Arcade	*
Ramopoly	48K Spec.	J Fletcher	Game	*
Rapedes	16K Spec.	Visions	Arcade	*
Red Weed	48K Spec.	Lothlorian	Simulation	7
Regression	16K Spec.	University	Utility	8
Regression	16K ZX-81	University	Utility	*
Renumber Delete	16K Spec.	Work Force	Utility	*
Renumber Delete	16K ZX-81	Work Force	Utility	*
Repulsar	16K Spec.	Softek	Arcade	*
Rescue	48K Spec.	Computer Rent	Arcade	*
Rescue	48K Spec.	Ocean	Arcade	*
Reversi	16K Spec.	Sinclair	Trad.	8
Rider	16K Spec.	Virgin	Arcade	6
Road Toad	16K Spec.	DK Tronics	Arcade	7
Robot Panic	16K Spec.	Soft Mill	Arcade	1
Robot Riot	48K Spec.	Silversoft	Arcade	*
Rommels Revenge	48K Spec.	Crystal	Arcade	8
Roulette	16K Spec.	Newsoft	Trad.	*
Roulette	48K Spec.	Dymond	Trad.	*
Roundsby Incident	48K Spec.	Add-on	Adventure	*
Royal Birkdale	48K Spec.	Ocean	Simulation	*
Sales Day Book	16K ZX-81	Transform	Business	*

Name	Machine	Company	Type	Gilbert factor
Sales Day Book	48K Spec.	Transform	Business	*
Sales Ledger	16K ZX-81	Hestacrest	Business	*
Santa	16K Spec.	Artic	Arcade	*
Satan's Pendulum	48K Spec.	Minatron	Adventure	7
Scrabble	48K Spec.	Sinclair	Trad.	8
Scuba Dive	48K Spec.	Durrell	Arcade	9
Secret Valley	16K Spec.	Newsoft	Adventure	*
Secret Valley	16K ZX-81	Newsoft	Adventure	*
Security Shelter	48K Spec.	Add-on	Arcade	*
Self-teach Program	16K Spec.	Anvil	Education	*
Self-teach Program	16K ZX-81	Anvil	Education	*
Sentinel	16K Spec.	Abacus	Arcade	7
Serpents Tomb	16K ZX-81	Vortex	Adventure	*
Shape Sorter	16K Spec.	Widget	Education	*
Shark Attack	16K Spec.	Romik	Arcade	*
Sheepwalk	48K Spec.	Virgin	Game	7
Sheer Panic	16K Spec.	Visions	Arcade	7
Ship of Doom	48K Spec.	Artic	Adventure	7
Shiva Special 1	16K Spec.	Shiva	Games	*
Shopping List	16K Spec.	SD	Utility	*
Sideways Copy	16K ZX-81	D King	Utility	*
Six Games	16K ZX-81	A Stubbs	Various	5
Sky Raider	16K Spec.	C M Smith	Arcade	*
Slippery Sid	16K Spec.	Silversoft	Arcade	8
Slow Loader	16K Spec.	ELR	Utility	9
Snail Logo	48K Spec.	CP	Educ/Lang.	8
Snooker	48K Spec.	Visions	Arcade	*
Softalk 1-2	48K Spec.	CP	Utility	8
Solaris	48K Spec.	Softel	Adventure	*
Solo Whist	16K Spec.	Video Soft.	Trad.	*
Sound FX	16K Spec.	dK' Tronics	Utility	6
Space Fighter	16K Spec.	Winters	Arcade	*
Space Intruders	16K Spec.	QS	Arcade	7
Space Lanes	16K Spec.	Cathedral	Arcade	*
Space Raiders	16K Spec.	Sinclair	Arcade	6
Space Raiders	16K ZX-81	Sinclair	Arcade	*
Space Station Zebra	48K Spec.	Beyond	Arcade	6
Space Trek	16K ZX-81	JRS	Arcade	*
Space Zombies	16K Spec.	Mikro-Gen	Arcade	*
Spanish Gold	48K Spec.	Chalksoft	Education	*
Speak and Spell	48K Spec.	S and G	Education	*
Spec. Assembler	48K Spec.	Artic	Utility	*
Spec. Bug	16K Spec.	Artic	Utility	*
Spec. Compiler	48k Spec.	Softek	Utility	7
Spec. Editor/ Assembler	16K Spec.	Picturesque	Utility	8
Spec. Forth	48K Spec.	Abersoft	Language	9
Spec. Forth	48K Spec.	CP	Utility	8
Spec. Frogs/ Showdown	16K Spec.	Artic	Arcade	*
Spec. Gobbleman	16K Spec.		Arcade	*
Spec. Invaders	16K Spec.	Artic	Arcade	*
Spec. Invasion Force	16K Spec.	Artic	Arcade	*
Spec. Microchess	16K Spec.	Artic	Trad.	*
Spec. Monitor	16K Spec.	Picturesque	Utility	8
Spec. Scramble	16K Spec.	Work Force	Arcade	7
Spec. Sound	16K Spec.	M Afzal	Utility	*
Spec. Tape Copier	16K Spec.	S Giza	Utility	*
Special Agent	16K Spec.	Heinemann	Education	*
Spectadraw 2	48K Spec.	McAlley	Utility	*
Spectipede	16K Spec.	R and R	Arcade	8
Spectral Invaders	16K Spec.	Bug-Byte	Arcade	8
Spectral Panic	16K Spec.	Hewson	Arcade	5
Spectres	16K Spec.	Bug-Byte	Arcade	6
Spectron	48K Spec.	Virgin	Arcade	6
Speech Marks	48K Spec.	Sinclair	Education	7
Spellbin	16K Spec.	Startersoft	Education	*
Splat	48K Spec.	Incentive	Arcade	8
Spreadsheet	48K Spec.	Microl	Business	7
Star Gazer	48K Spec.	CRL	Utility	8
Strike Four	16K Spec.	Spectresoft	Various	4
Styx	16K Spec.	Bug-Byte	Arcade	7
Sub	16K Spec.	Romik	Arcade	*
Super Play I	16K Spec.	Video	Games	*
Superchess II	48K Spec.	CP	Trad.	8
Superchess Three	48K Spec.	CP	Mind Game	9
Supercode	16/48K Spec.	CP	Utility	*
Superspy	48K Spec.	Shepherd	Adventure	5
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Tai	16K ZX-81	PSS	Game	*
Tank Battle	16K Spec.	dK' Tronics	Game	8
Tape Breaker	16K Spec.	Spectrasoft	Utility	*
Tape Copier	16K Spec.	Lerm	Utility	*
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Tasword	48K Spec.	Tasman	Business	8
Tasworld II	48K Spec.	Tasman	Business	9
Teach Data	48K Spec.	B Farris	Education	*
Teacher Data	48K Spec.	B Farris	Education	8
Teacheraid	16K Spec.	B Farris	Education	*
Tennis	16K Spec.	Winters	Game	*
Tenpin	16K ZX-81	Phipps	Game	*
Terror from The Deep	48K Spec.	Add-on	Adventure	*
Test Match	48K Spec.	Computer Ren.	Sim.	*
Text	16K ZX-81	Contast	Bus.	8
The Castle	48K Spec.	Bug Byte	Adventure	*

Name	Machine	Company	Type	Gilbert factor
The Devil Rides In	16K Spec.	Carnell	Arcade	*
The Forest	48K Spec.	Phipps	Sim.	*
The Great Western	16K Spec.	New Soft	Game	*
The Great Western	16K ZX-81	New Soft	Game	*
The Key	16K Spec.	Keysoft	Utility	*
The Orb	48K Spec.	Computer Ren.	Adventure	*
The Pyramid	48K Spec.	Fantasy	Arcade	7
The Settler	16K Spec.	BSS	Utility	*
The Settler	16K ZX-81	BSS	Utility	*
The Turk	48K Spec.	OCP	Trad.	8
Three Games Cassette	1K ZX-81	McGraw Hill	Various	8
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3D Strategy	48K Spec.	QS	Mind Game	8
3D Tunnel	48K Spec.	New Gen.	Arcade	9
Time Bandits	16K Spec.	New Soft	Adventure	*
Time Bandits	16K ZX-81	New Soft	Adventure	*
Time Gate	48K Spec.	QS	Arcade	8
Time Quest	48K Spec.	Mikro-Gen	Adventure	*
Tobor	48K Spec.	Add-on	Arcade	7
Tomb of Dracula	16K ZX-81	Felix	Adventure	*
Tomb of Dracula	48K Spec.	Felix	Adventure	*
Trace	16K Spec.	Zen	Utility	*
Trace	16K Spec.	Texgate	Utility	8
Trace	16K ZX-81	Texgate	Utility	7
Tradewind	48K Spec.	WDS	Strat.	*
Train Game	16K Spec.	Microsphere	Game	9
Transylvanian Tower	48K Spec.	Shepherd	Adventure	7
Tranz Am	48K Spec.	Ultimate	Arcade	*
Traxx	48K Spec.	QS	Arcade	7
Troon	48K Spec.	Hornby	Game	8
Tube Train Terror	48K Spec.	JRS	Game	*
Tutankhamum	48K Spec.	Micromania	Arcade	8
Urban Upstart	48K Spec.	Shepherd	Adventure	*
Use and Learn	16K Spec.	Microl	Utility	8
Utility File	48K Spec.	SD Micro	Business	*
Valhalla	48K Spec.	Movisoft	Adventure	7
Vampire Village	48K Spec.	Terminal	Adventure	4
Velnor's Lair	48K Spec.	QS	Adventure	8
Voice Chess	48K Spec.	Artic	Trad.	9
Volcanic Dungeon	16K ZX-81	Carnell	Adventure	*
Volcanic Dungeon	48K Spec.	Carnell	Adventure	6
Vortex	16K Spec.	JK Greye	Arcade	5
Vu-Calc	16K Spec.	Sinclair	Business	7
Vu-File	16K Spec.	Sinclair	Business	8
Vu3D	48K Spec.	Sinclair	Utility	8
War 70	48K Spec.	CCS	Strat.	8
Warlock of Firetop Mountain	48K Spec.	Penguin	Arcade	*
Warlord	48K Spec.	Lothlorian	Sim.	*
Wheelie	48K Spec.	Microsphere	Arcade	7
Whizz Kid	48K Spec.	C. Tutor	Education	*
Who Dares Wins	48K Spec.	E. Midland	Adventure	*
Wizard's Warriors	16K Spec.	Abersoft	Arcade	*
Word Fit	16K ZX-81	Ram Writer	Game	6
Word Processor	48K Spec.	Microl	Business	*
World Info	48K Spec.	Wimsoft	Utility	*
World of Illusions	16K ZX-81	Constrast	Adventure	4
Wrath of Magra	48K Spec.	Carnell	Adventure	*
X Ray	16K Spec.	Zen	Utility	*
Xadom	48K Spec.	QS	Arcade	4
Yahtzi	48K Spec.	Work Force	Trad.	*
Yomp	16K Spec.	Virgin	Arcade	7
Zeus Assembler	48K Spec.	Sinclair	Utility	9
Ziggarat of Dread	48K Spec.	Add-on	Adventure	*
Zodiac F	48K Spec.	Stellar	Utility	7
Zodiac I	16K ZX-81	Stellar	Utility	*
Zodiac II	16K ZX-81	Stellar	Utility	*
Zuckman	16K ZX-81	DJL	Arcade	8
ZX 1K Chess	1K ZX-81	Artic	Trad.	*
ZX Compiler	16K ZX-81	Silversoft	Utility	*
ZX Draughts	48K Spec.	CP	Trad.	*
ZX Forth	16K ZX-81	Artic	Language	8
ZX Forth	48K Spec.	Artic	Language	8
ZX Invasion Force	16K ZX-81	Artic	Arcade	*
ZX Panic	1K ZX-81	Selec	Arcade	4
ZX Screenkit	4K-64K ZX-81	Picturesque	Utility	*
ZX-81 1K Games Pack	1K ZXZ-81	Crystal	Games	9
ZX-81 Pocket Book	16K ZX-81	Phipps	Games	*
ZX-81 Remload	16K-64K ZX-81	Picturesque	Utility	*
ZX-Bug	16K ZX-81	Artic	Utility	*
ZX-Chess I	16K ZX-81	Artic	Trad.	*
ZX-Chess II	48K Spec.	Artic	Trad.	*
ZX-sideprint	16K ZX-81	Microsphere	Utility	*
ZXAS	16K ZX-81	Bug Byte	Utility	*
ZXDB	16K ZX-81	Bug Byte	Utility	*
ZXED	16K Spec.	dK' Tronics	Utility	*

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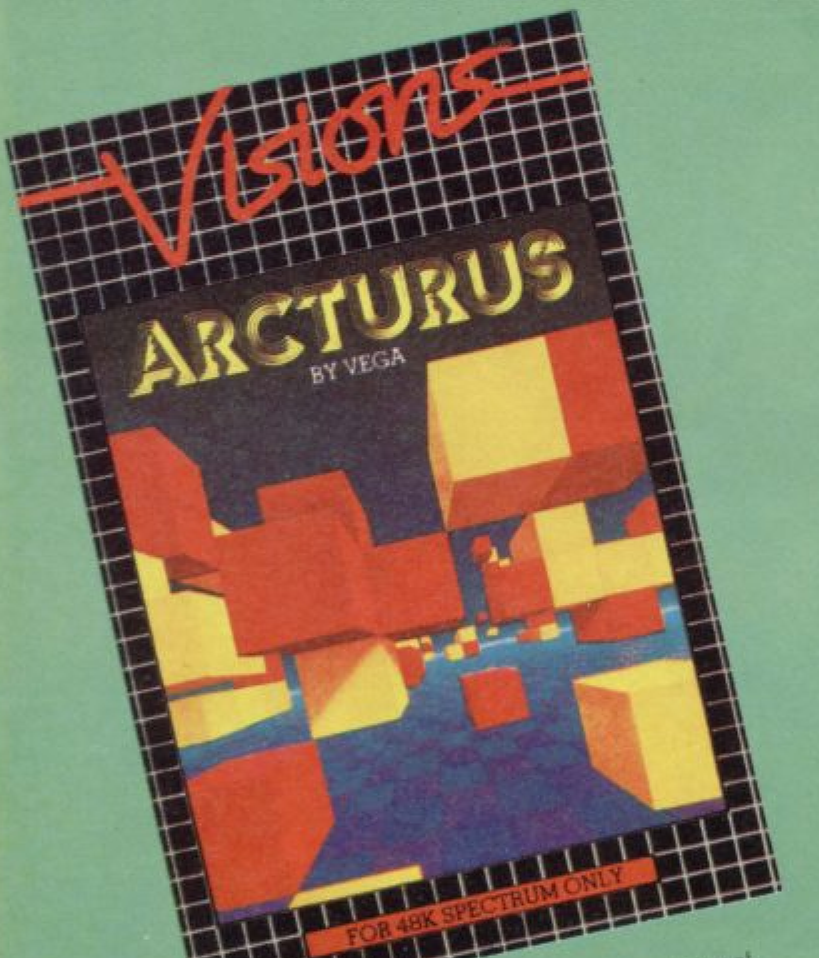
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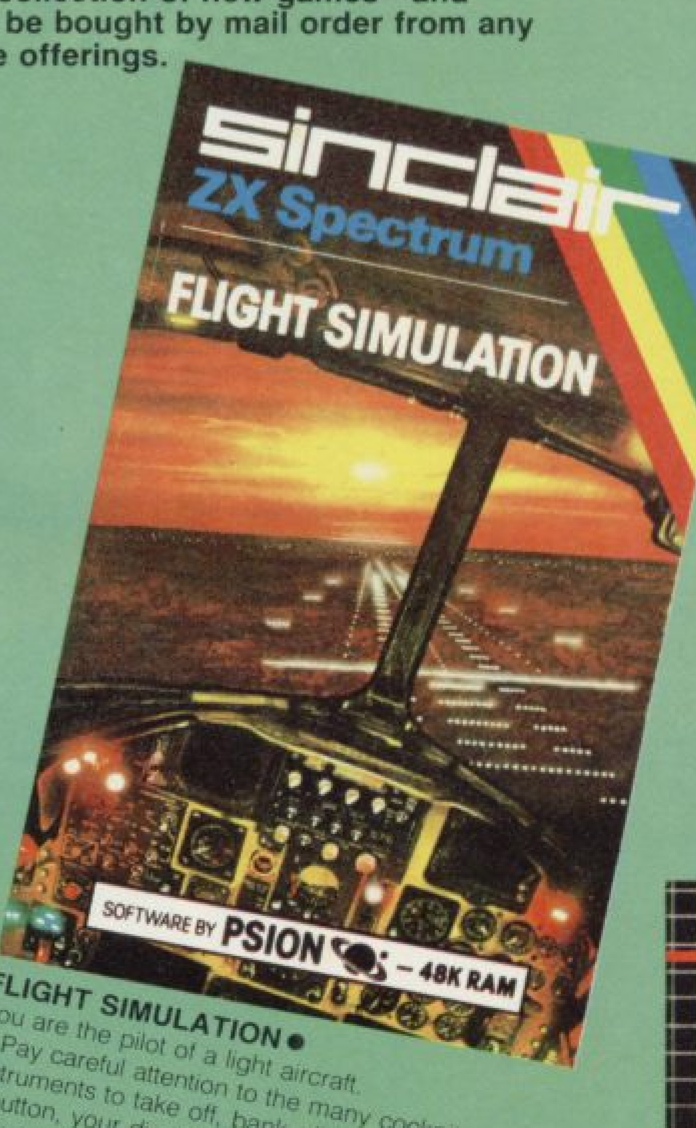
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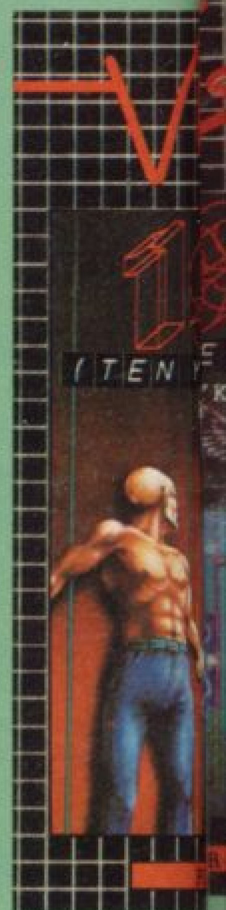
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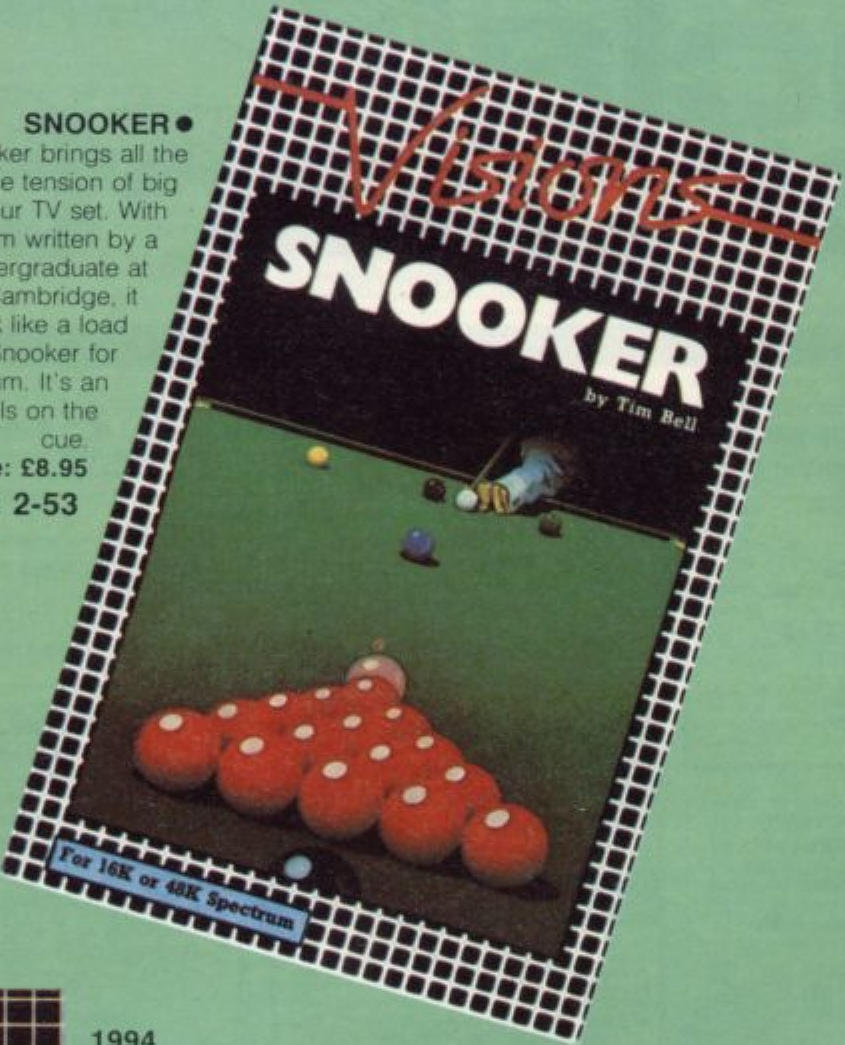
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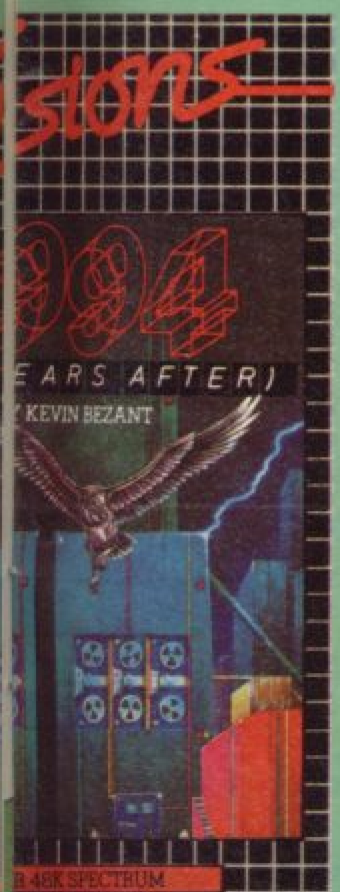
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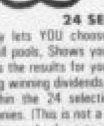
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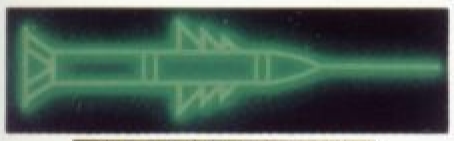


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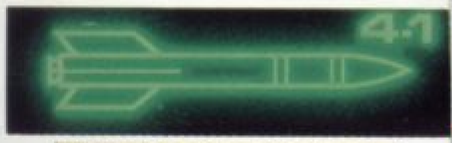
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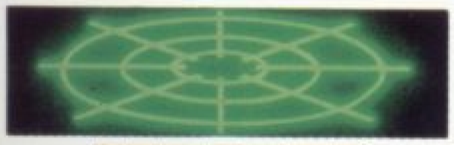
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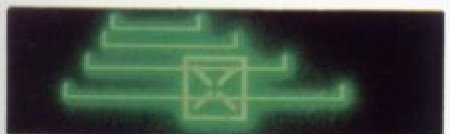
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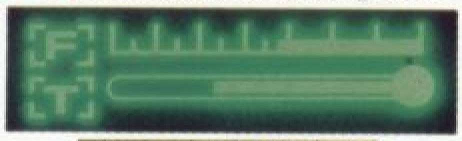
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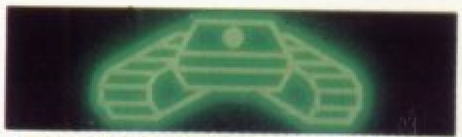
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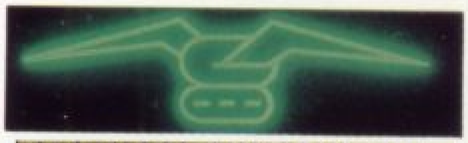
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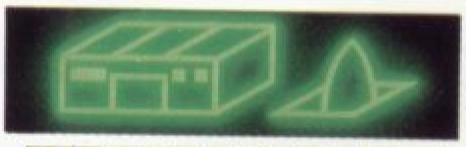
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